THE PROCEEDINGS

OF THE

ROYAL

ENTOMOLOGICAL SOCIETY

OF LONDON

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Wednesday, 7th February, 1934.

Dr. S. A. NEAVE, O.B.E., President, in the Chair.

Vice-Presidents.

The PRESIDENT announced that he had nominated Professor W. A. F. BALFOUR-BROWNE, F.R.S.E., F.L.S., Sir THOMAS HUDSON BEARE, F.R.S.E., and Dr. V. B. WIGGLESWORTH as Vice-Presidents for the year.

Election of Fellows.

The following were elected Fellows of the Society :—RICHARD ESTLIN HALL, B.Sc., 30, Murray Road, Wimbledon, S.W.19; GEOFFREY JOHN KERRICH, B.A., Junior Curator, Museum of Zoology, Cambridge; GEORGE COPLEY VARLEY, B.A., Department of Entomology, Cambridge; ANTHONY EDWARD WELCH, 20, Tanza Road, N.W.3.

Exhibits.

The following communications were then made to the meeting :—

***Oxypoda filiformis* Redt. recorded from Britain.** By H. ST. J. K. DONISTHORPE.

Two specimens of *Oxypoda filiformis* Redt., a beetle new to Britain, were exhibited. They were taken in Windsor Forest on 1st Oct. 1933, when sifting straw refuse and at once recognised as a species not previously taken there. With the assistance of Dr. M. Cameron it was determined as *O. filiformis*, a species not previously recorded from Britain. It is recorded from Germany, Austria, Hungary, Croatia and Turkey in moss, twigs, straw, sweepings, etc., but it is always rare.

Phenological Records. By Maj. H. C. GUNTON.

In February 1921 I gave some preliminary results of the phenological records which I had kept during the previous few years. The present results are a continuation of the observations from that time onwards. In 1925 I plotted a diagram which shows the overall lives of the species from the earliest to the latest observations

available in my note book, with a note as to the years in which the earliest appearances were noted. I find this diagram a useful reminder of the periods within which species are liable to be seen. No season subsequent to 1925 has made revision of this diagram so necessary as 1933. I feel very strongly that those of us who pursue the study of entomology, as amateurs, have opportunities, perhaps not fully grasped, of helping those who are engaged in that subject professionally, and that if we were to collaborate more fully in getting systematic records in forms which would facilitate their assimilation we could make really valuable contributions. My convictions were strengthened by reading the paper by Mr. Uvarov on "Insects and Climate" read 5th November, 1930, and printed in 1931, *Trans. Ent. Soc. Lond.*, **79**. The following are brief extracts :—

(*a*) Climate is the ever present, if not always the dominant factor in an insect's life.

(*b*) An insect living under natural conditions is not only exposed to one isolated climatic factor but to the continually changing combinations of several.

(*c*) All the more usual combinations of factors should be studied. Unfortunately very little work has been done in this direction.

Before proceeding with the plotting of further diagrams I have, through the courtesy of Mr. Fryer, been in communication with the Rothamsted Experimental Station and found that considerable importance is attached to systematic records of the kind which I have described, and that the Lepidoptera are considered to be the most suitable medium for the study of relationship with climatic conditions owing to the relative facility of identification and the great variety of their life-histories.

As the result of consultation with Dr. Williams, head of the Entomological Department at Rothamsted, I have selected 50 common species, have averaged the dates of appearance and have plotted them on a diagram which also includes the average dates for sallow blossom, larch, elm and oak foliation and ivy blossom which I have always found useful plant indices.

On prints from this diagram the earliest dates for particular years can be plotted. There is no difficulty with regard to the meteorological particulars. The monthly reports of the Meteorological Office and the Phenological Reports issued by the Royal Meteorological Society contain the particulars referable to districts and localities which are applicable to the entomological observations. As examples I have plotted from these sources the monthly excesses and deficiencies of temperature and the corresponding weekly temperatures and also the average and actual accumulated temperatures.

In trying to appreciate the conditions which govern emergence the other factors already referred to must also be taken into account, consideration being given to a prior period of some duration as well as to the time of emergence.

These diagrams are, at this stage, sure to contain inconsistencies and inaccuracies, some of which are obvious. For instance, accuracy must depend on the climatic conditions of the moment, unsuitable conditions such as bad weather or bright moonlight militating against the observation of insects which have already emerged. On the other hand it is not to be expected that the different species will respond in the same way and in the same degree to the variations of a season, for

climatic conditions must affect them differently, not only having regard to the state of development in which they encounter these conditions, but also to the degree of exposure involved by their habits. Obviously a bare pupa differs in this respect from one in a cocoon and each would differ according to whether it was fully exposed to the atmosphere or partially protected by leaves or the roots of herbage or buried in the earth at a certain depth. Similar considerations apply to other periods of the insect's life.

It will be evident that there are many directions in which to probe if once we can get our facts right and it is on these facts that we should first concentrate. It cannot be done by a single observer. If, however, a sufficient number of observers volunteered we should, in time, arrive not only at approximately accurate district diagrams but we should be able to arrive at local diagrams corresponding to the same localities as those used by the meteorological authorities, and, looking still further ahead, arrive at diagrams of the different life stages in the natural state of insects of different habits. The most I have hoped to do by means of the diagrams placed before you is to indicate a common basis for exploring a wood containing many trees worthy of study.

In conclusion there is one point I should like to make clear: observers would not be required to plot the diagrams although they may find it interesting to do so.

If lists of first appearances are forwarded addressed to me at the Royal Entomological Society, 41 Queen's Gate, S.W.7, they will be compared, co-ordinated, analysed and plotted in consultation with Rothamsted Experimental Station.

Copies of the list of insects will be supplied to those who volunteer to keep records; probably three or four volunteers from a district should be ample.

On an Association between an Ichneumonid and a Tachinid. By D. J. Lewis.

Specimens of *Osprynchotus gigas* Kriechb. (Ichneumonidae) and *Roubaudia rufescens* Vill. Tachinidae, collected at Gadau in Northern Nigeria in July and August 1933 were exhibited. The former was very common at the beginning of the rainy season, and on two occasions a female was seen indoors being followed at a distance of about six inches by the fly (once a male and once a female). The latter kept its distance as if attached to the Ichneumonid by an elastic cord, hovering or flying slowly behind the larger insect. Once the fly followed the Ichneumonid for ten minutes and then the two flew independently for fifteen minutes, often passing within a foot or two of each other. The fly suddenly reduced its speed and began again to follow the slowly-moving Ichneumonid.

In his studies on the African social wasps, Roubaud * records that *R. rufescens* parasitises *Belonogaster* and *Icaria* in the Congo. He mentions the difficulty experienced by the female *Roubaudia* in approaching the nests of these wasps which sit in clusters outside. The fly avoids the wasps either by means of its high speed or by waiting till they are temporarily inactive or absent from the nest. It would be interesting to know why *Roubaudia* was following the Ichneumonid, which is a parasite of solitary wasps (*Eumenes*). Perhaps it is in the habit of following *Osprynchotus* as another means of approach to the nest and mistakes this insect for the large Vespid.

* 1924, *Ann. Sci. Nat.* (*Zool.*) 7 : 197–248.

The Swarming Habits of some West African Diptera. By D. J. Lewis.

Specimens of *Thrypticomyia seychellarum* Edw., a Tipulid with white tarsi, collected at Freetown in September 1933, were also exhibited. From one to five individuals of this species were frequently seen hanging from spiders' webs. They held their wings and legs outstretched, and, since they were always seen against a dark background, a stream, the eaves of a house, or the roots of trees, their white tarsi were very conspicuous. Also they jumped up and down on the web. If driven away, the insects often returned to the web, flying up and down till their anterior legs became attached. Pairing occurred when the flies were hanging from the web.

Milichiella sp., a small fly in which the upperside of the abdomen has the appearance of silver, was commonly seen at Gadau from May to August, the males flying in groups of about fifty at the bases of Baobab trees (*Adansonia digitata*). The climate in May was hot and dry, the temperature being often in the region of 40° C. (104° F.) for several hours and the relative humidity often falling below 10%. Many insects such as ants and termites remained below ground throughout the day, yet these flies swarmed only in sunshine. They remained on the sunny side of the tree, moving round from east to west and keeping their position regardless of the direction of the wind. The position of the swarm evidently does not depend on reflected light from the tree trunk, since swarms were observed against a black iron post.

Milichiella argentea F. closely resembles the above species and was daily seen swarming at Freetown in September 1933. The swarms, consisting of ten to fifteen flies, were never seen near trees but always against the walls of a house (the Sir A. L. Jones Laboratory) about twenty feet from the ground. The swarm travelled from east to west a distance of about one hundred and sixty feet, always being opposite the place at which the rays of the sun were most nearly vertical to the wall. The swarm, therefore, moved slowly round the angles of the house. Photographs showed the position of the swarm against the brightest part of the wall. At midday, when the sun was almost vertically overhead, this position was dependent on the extent of the eaves.

I have to thank Sir Guy Marshall, who very kindly arranged for these insects to be identified.

Prof. P. A. Buxton referred to his observations on Tipulids of the genus *Trentepohlia* Big. in Samoa.* He said that several species habitually sit in dark places in the forest, for instance, between buttress roots, and often large numbers are found close together. Frequently an area of bark seems to shimmer owing to the numbers of *T. pacifica* Alex., a species with whitish markings on the legs, which stand and sway themselves on it.

Certain spiders have the same habit of swaying in their webs and also resemble the Tipulids in colour.

Colour variation of *Triatoma rubrofasciata*. By J. D. Gillett.

Four adult specimens of *Triatoma rubrofasciata* were exhibited showing a colour variation of the pronotum due to lack of pigment. The first was a normal adult,

* 1928, *Proc. ent. Soc. Lond.*, **2**: 65.

in which the pronotum was quite black except for a reddish margin. In the second the pronotum was divided transversely into two almost equal portions, the anterior portion being black, and the remaining portion reddish-orange. He said that he had found that approximately 14% of the adults were of this form (having made the observations from about 60 insects), although in many of them the reddish-orange portion was much darker than that of the one shown; in fact, in some it was little more than a very dark brown.

The other two insects had, in addition to the reddish-orange portion on the pronotum, other differences of colour. One having a pink patch on the wing, and the other being quite normal down the whole of the right half, but on the left it had a large pink patch on the wing, one orange leg, and instead of the pronotum being divided transversely, it was divided longitudinally into two almost equal portions, the right, the normal side, being black, and the left reddish-orange.

Two of the insects shown had also a reddish apex to the scutellum. In Patton and Cragg's *Text Book of Medical Entomology*, 1913, the scutellum was described as having the apex occasionally reddish, but no reference was made to the striking colour variation of the pronotum, it being described as being dark brown to black.

The insects on which the observations were made originally came from Assam in 1927, and since that date they had been kept at a constant temperature of 23° C.

A remarkable new Dipteron from Kenya Colony. By Sir Guy Marshall, C.M.G., F.R.S.

Two specimens of a very remarkable new Dipteron found in Kenya by Mr. H. B. Sharpe in a cave frequented by bats and swifts were exhibited on behalf of Dr. V. G. L. van Someren. The insects bear an extraordinary superficial resemblance to Nycteribiidae, to which they are, however, in no way related, as they have a large fleshy proboscis and rudimentary wings. Major E. E. Austen suggests that the species may belong to the Dryomyzidae, but that probably a new family may have to be erected for it.

Prof. P. A. Buxton remarked that an affinity with the Dryomyzidae had been suggested. The aberrant *Neottiophilum* is a member of that family, or closely related thereto, and its larva is a blood sucker, living in birds' nests. It might be well to search the swifts' nests in the cave, in the hope of finding the larvae of the remarkable fly which was exhibited.

Separation of Lice from Hair, Wool or Feathers. By Prof. P. A. Buxton.

Keratin (which is the principal constituent of hair, wool and feathers) is soluble in alkaline solutions of sulphides. As the material goes into solution, the alkalinity drops, and it appears that the p_H should be maintained at or beyond 11·0. In practice it is not easy to measure the p_H, for the solutions are coloured and turbid, but one can find an empirical formula which gives satisfactory results: it seems that the best proportion is 2% sodium sulphide and 2% potassium hydroxide in water. The material should be put in this solution and boiled or set in a bath of boiling water. A large volume of solution must be used; 200 cc. of the above per gram of hair is sufficient. The material must be maintained at or near boiling

point until it filters readily. Whatman's No. 3 paper allows very quick filtration and is resistant to the solution.

The same technique has been applied to feathers, and even the stiff " rhachis " or mid-rib of the feather dissolves readily. But the basal part of feathers of many birds contains a black pigment which is not altered, and which makes it impossible to see the lice when all the feather has been dissolved. A method of overcoming this difficulty is described below. The same solution readily dissolves a flannel shirt, but the lice will be found tangled up in the cotton threads which were used for stitching the garment together. It is desirable, therefore, to find a solvent for cellulose which would not attack chitin.

If the hair or other material contained lice, they can be found on the filter paper. The external skeleton is not touched by the solution and the insects are not rendered brittle, but they are transparent and difficult to see. It is best, therefore, to wash them off the filter paper with a stream of distilled water and stain them in eosin. It is found that other stains, for instance fuchsin and carmine, are destroyed by the traces of reagent which remain in the specimens. The black pigment, which is so abundant in black hair or feathers, will not pass through even a coarse filter paper. In this case it is best to remove the lice from the solution by flotation. After the hair has been dissolved by heat, the liquid is put in a stoppered separating funnel, with liquid paraffin, and shaken. The lice become wet with the paraffin and float up with it, the black liquid remaining below and being allowed to run off through the cock at the bottom of the funnel.

The methods here described have a number of possible applications. They permit one to collect lice with a minimum of trouble from a large sample of material. They should also make it easy to study the changes in seasonal incidence of these insects in populations.

Wednesday, 7th March, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Election of Fellow.

The following was elected a Fellow of the Society:—Herbert M. Lloyd, 6, Southwood Lawn Road, Highgate, N. 6.

Obituary.

The death of Mr. R. Kelly, a Fellow of the Society, was announced.

Exhibits.

The following communications were then made to the meeting:—

A probable natural Hybrid between the Geometrid species *Erannis aurantiaria* Esp. and *E. defoliaria* Clerck. By C. N. Hawkins.

The specimen shown, a ♀, was bred by me from a larva collected amongst others on Wimbledon Common in May or June 1912, and emerged on the 23rd Dec., 1912. It has, very clearly defined, the markings of a *defoliaria* ♀, but the ground-colour is

golden-yellow instead of the usual pale whitish-yellow, and it has partially developed wings 2 mm. in length, whereas those of *defoliaria* ♀ are quite vestigial. I had always regarded it, nevertheless, merely as an abnormal *defoliaria*, but on looking at it again recently it occurred to me that it might be a natural hybrid between that species and *aurantiaria*, and further investigation tends to confirm the latter view. An examination of the genitalia *in situ* seems to me to give no satisfactory results, but if they were dissected out they might show recognisable differences. Fortunately, however, it is unnecessary to rely on the genitalia, as the maxillae afford perfectly good specific characters, not only in *defoliaria* and *aurantiaria* but also in *E. marginaria* Bkh. (*progemmaria* Hb.), the last being a species which might be involved as an alternative to *aurantiaria*. An examination of all three species, and of the suggested hybrid, under a magnification of 120 diameters gives the following results :—In *defoliaria*, the maxillae are rudimentary, ·6 mm. in length, white, fleshy looking, covered with minute hairs or spines, not joined together to form a proboscis and not coiled, but projecting quite separately and rather divergent towards the tips. They are difficult to see, being almost hidden amongst the scales of the head. In *aurantiaria* the maxillae are much better developed; 2 mm. in length, yellowish, hairy, joined together to form a sucking tube or proboscis and probably just functional for the purpose of sucking moisture off bark, twigs, etc. The proboscis is usually carried coiled in watch-spring fashion, and when straightened reaches back to between the bases of the front pair of legs. In *marginaria* the proboscis is still better developed, longer, darker (more heavily chitinised), more shiny, with some very minute hairs on the basal portion, and is carried well coiled. In the suggested hybrid the tongue is definitely like that of *aurantiaria* and is quite as long, although the left maxilla is slightly shorter than the right one. The maxillae are joined to form a proboscis but are not coiled, though this may be accidental. The ground-colour is that of normal *aurantiaria* males. In *aurantiaria* females the wings are 3 mm. in length and the colour is a rather dirty grey-brown. All the measurements given for *defoliaria* and *aurantiaria* are subject to slight individual variation according to the size of the specimen, but the variation is so slight that it can safely be ignored for the present purpose. To sum up, this remarkable specimen has the pattern of female *defoliaria*, the ground-colour of male *aurantiaria*, the proboscis of *aurantiaria* and wings 2 mm. in length as compared with the vestigial wings of female *defoliaria* and the 3 mm. wings of female *aurantiaria*. In the circumstances, I think it is a fair assumption that this is a natural hybrid.

A Living Tortoise-beetle from Nigeria. By Dr. K. G. Blair.

The specimen of *Aspidomorpha cincta* F. exhibited was received from Dr. Guy Morison of Aberdeen. The beetle was captured near Minna, Niger Province, by Mr. G. Wilson in November last. It had been given leaves of privet, dock and dandelion but did not appear to have fed, nor did it take any notice of apple peel. The convex portion of the thorax and elytra, that appear dull reddish-brown in dried specimens is of a uniform bright golden colour, the expanded margins, except for golden bands that cross them, clear, translucent. The colour appears to remain constant whether the insect is active or sluggish, there being no suggestion of the remarkable change of colour that takes place on the insect resuming activity that is observed in the North American *Metriona bicolor* F. Here the golden colour remains

so long as the insect remains quiet, but if excited the thorax becomes a greenish-golden, the elytra purplish-red with a bluish or purple opalescence. As it settles down again this fades away and the gold returns. (See *Proc. S. Lond. Ent. Soc.*, **1928–29 : 74**).

Notes on African Lepidoptera. By H. C. Kenway of Pretoria.

Prof. Poulton communicated the following interesting observations extracted from a letter written, 21 January, 1934, by his friend Mr. H. C. Kenway, F.R.E.S. :—

The attacks of birds upon butterflies.—" In the days when I knew nothing of these controversies, I had long been convinced that birds are eaters of butterflies. I had so often lain under a tree watching my baits and amusing myself by observing flycatchers, wagtails and other small birds taking Lycaenids and small Pierids that the thing had become a commonplace and I did not consider the possibility of anybody doubting it.

" To give concrete and more recent instances :—In January 1930 at Wonderboom, Pretoria, I watched flycatchers taking *Terias brigitta* Cram. on flowers. The birds sat on a low branch about ten feet distant and every time a butterfly perched on a flower one of the birds shot out and snapped at it. If he missed I heard the click of his bill and he turned back to his perch and sat down again. If he caught it he wiped off the wings against the branch and swallowed the body. I was ten yards away and used a pair of × 6 prism binoculars, so there was no doubt about it. I afterwards picked up over 30 fore-wings under the branch without searching at all carefully.

" At Eshowe in Zululand in December 1926 I counted 83 fore-wings of *Charaxes druceanus* Butl., *ethalion* Boisd. and *cithaeron* Feld. scattered below a tree in which was a large bird's nest. I did not see the bird and could neither dissect it nor apply emetics or a stomach pump, so that there are three alternatives open to our learned friends. Either (*a*) at least 44 *Charaxes* shed their wings (as do termites) under the one tree, (*b*) they formed a suicide club and employed somebody or something to immolate them, or (*c*) the birds ate them. The tree was not a ' sucking tree,' and I have never seen *Charaxes* frequenting it though I have often looked for them with my field glasses. The nearest *Charaxes* resort is about 100 yards away."

The following note refers to a beautiful drawing painted by Miss Kenway and exhibited to the meeting :—

" The Christmas-card shows the male *Ch. bohemanni* Feld. as he looks when excitedly hunting a nice smelly place in the mud. I wonder whether the *Papilio*-like position of the wings is protective ? It seems absurd, but it is only when at a mud puddle such as *P. lyaeus* Dbl. loves that *bohemanni* throws his wings forward like a *Papilio*, so it is just possible that there may be something in it. I have never seen *lyaeus* with mutilated wings suggesting bird attack."

A carnivorous Sphingid larva.—" I do not know whether I told you that I actually watched the larvae of *Pseudoclanis postica* Walk. eating one another. It was most interesting. One of the big larvae, after eating his old skin, strolled over to a smaller one which was half out, and nibbled at the loose skin on the middle segments till he came to the portion still adhering, and then proceeded to eat right through him in spite of a valiant resistance."

The migration of C. florella and other Pierine butterflies.—" 21 *January*, 1934—For the last four days *Catopsilia florella* F. has been migrating (from S.W. to N.E. as usual) accompanied by a few *Belenois mesentina* Cram. and *B. gidica* Godt.

" 7 *February*.—The flight of *C. florella* has developed in rather an unusual manner. After about ten days I noticed an increasing number of other Pierines whilst *florella* almost disappeared, being gradually replaced by *B. gidica*, *mesentina* and *severina* Cram., accompanied by *Colias electra* L., *Teracolus subfasciatus* Swains. and one or two other Teracoli which I failed to determine.

" The migration only finally petered out yesterday, though the butterflies have been dying all over the place for about a week. From newspaper reports I gather that the flight has been at least 300 miles wide and has lasted about three weeks. I feel sure that the migrants have been reinforced during the flight, as many butterflies are so old and transparent as to resemble Acraeas, while others are newly hatched, with all gradations between these two extremes."

Comments on the discussion of 7 December, 1932, with additional evidence on the efficiency of special protection and warning characters, etc. By H. N. Ridley.

Prof. Poulton communicated the following interesting notes of observations contained in a letter dated 15 June, 1933, from his friend Mr. H. N. Ridley, F.R.S.: —" The picture* of the viper-like caterpillar is good, but it is even more viperine in look when the ' head ' peers over the leaf edge. The discussion † on the attacks of birds, etc., on protectively or warningly coloured insects is also very interesting.

" Only two or three days ago I saw on Holmwood Common the fritillary *Melitaea athalia* Rott., which haunts an open marsh there, fly to a small wood, when from the deep shade of an oak a bird darted out at it. Both bird and insect disappeared in a bramble thicket, but I had no doubt that the butterfly had been captured.

" A common invader of my verandah at Singapore at night was the Zygaenid (Chalcosiinae) moth *Pintia sordida* Walk., dark brown purple above with pale blue, white spotted under-wings. Adult geckos ignored it, but one evening I saw a young gecko stalk this moth and seize it by the anterior end so that head and thorax were within the mouth. The gecko quickly opened its mouth and released the moth, which was quite unhurt and walked away, and after cleaning its plumed antennae, head and thorax of the lizard's saliva, flew off. Meantime the gecko rushed away pawing its mouth frantically and shaking its head—a comical sight.

" A small brown Lampyrid beetle ‡ used to fly into light and creep on the verandah ceiling. A young gecko stalked one and was just about to seize it, when the beetle flashed its light and the gecko turned and bolted to the seclusion of the cornice. I have, however, seen apparently the same Lampyrid flying in numbers into the verandah of a house at Penang and captured by spiders, regardless of their

* 1932–33, *Proc. ent. Soc. Lond.*, **7**: pl. I.

† 1932–33, *loc. cit.*, **7**: 79–105.

‡ My friend Dr. K. G. Blair suggests that this small Lampyrid may be the abundant Oriental *Luciola vespertina* Fab. and that the larger beetle mentioned below may be a species of *Rhagophthalmus* belonging to the family Rhagophthalmidae, allied to Lampyridae. My friend Mr. C. L. Collenette suggests that the lizard may be the house-gecko—*Hemidactylus frenatus*, common in Singapore. I have also received kind help with the Lepidoptera from my friend Mr. W. H. T. Tams. The behaviour of the Singapore geckos towards the Zygaenid moth affords an interesting comparison with that of the Kuala Lumpur geckos towards a conspicuous Hypsid moth, as recorded by Dr. W. A. Lamborn, O.B.E., F.R.E.S., in our *Proceedings* **1921**: vii.—E.B.P.

light. The larval (or female) form of one of the bigger species, very common and ornamented with a row of lights along the sides, used to creep about my bathroom, and my terrier going to inspect it and putting his nose to it, frantically sneezed and rubbed his nose on the bricks to get rid of the smell, which to me was only a faint musky one, like that of the moth *Attacus atlas* L. but fainter.

" One day we gave a monkey a handful of dead mixed butterflies, including Pierids and Danaids. He ate all the insects but left the latter supposed uneatable ones to the last.

" In reference to the nesting association between birds and wasps described in 1932, *Proc. ent. Soc. Lond.*, **7** : 55–6, I remember seeing the nests of Weaver Birds (*Ploceus*) surrounded and defended by wasps' nests near Nompenh, the capital of Cambodia. We had been out for a car drive and the car broke down and had to be towed to the town by oxen. As we went slowly along the Frenchman I was with pointed out the Weaver birds' nests, saying that they always hung them near wasps' nests, and indeed one could see the wasps flying about and their nests too."

Dragonflies captured by European and British Birds. By the Rev. F. C. R. Jourdain, M.B.O.U.

Prof. Poulton said that his friend, writing 16 Dec. 1933, had kindly sent the following observations which, in view of the scarcity of recorded prey from among the Odonata, were well worth communicating to the Society.

" I have seen Black Tern (*Chlidonias n. niger* L.) chasing and capturing Dragonflies on Naarder Meer in Holland. I think the species was the Demoiselle (*Calopteryx virgo* L.), but the observation was made at some distance with glasses.

" In *Country Life*, 14 Oct. 1933, p. 399, there is a photograph by Miss Pitt of a ♂ Spotted Flycatcher (*Muscicapa s. striata*) bringing a Dragonfly to the ♀ at the nest. She describes the Dragonfly as blue winged, so I expect this is also *C. virgo*. The insect is very plainly visible in the photograph."

A Note on the Eggs and Breeding Habits of *Salda littoralis* L. (Heteroptera, Saldidae). By Maud D. Haviland Brindley.*

On June 30th, 1932, I collected a few *Salda littoralis* on the salt marshes at Cley in Norfolk. After mating, one female was placed in a petri dish provided with a lump of mud, and four days later eight eggs were deposited. The egg of *S. littoralis* is elongate-oval, and slightly curved and pointed at the posterior pole. Ekblom (1926, *Zool. Bidrag, Uppsala*, **10**) has described the egg of *Salda saltatoria* L., and Hungerford has given an account of some American species, but neither mentions the existence of a so-called "micropyle " region, comparable to that found in most heteropterous eggs. In *Salda littoralis*, on a small area at one side of the hinder end of the egg, the otherwise smooth surface of the chorion is longitudinally marked with fine ridges or corrugations. This arrangement is quite distinct from that found in other bugs' eggs that are known to me ; but sufficient material is not yet available to determine whether it occurs in all Saldidae. The margin of the striated area is

* Communicated by Prof. E. B. Poulton, F.R.S.

not well defined, and it may therefore easily be overlooked. If this character occurs throughout the family, the egg-form of the SALDIDAE is quite distinct from that of the GERRIDAE and VELIIDAE which from previous accounts it seemed to resemble.

The eggs were inserted in the wet mud with the posterior pole protruding slightly from the surface. Oviposition was observed in only one case, and there the bug backed up against a sloping surface into which the egg was rapidly thrust home with a jerk of the abdomen. The dish was covered and the contents kept moist at room temperature. In seven out of the eight eggs, development took place, and at the end of August, the red pigmented eyes and limbs of the embryos were visible through the transparent chorion. They remained in this state throughout the winter, and in the middle of the following March two nymphs hatched out. The latter both died in the second instar, probably because I did not provide them with suitable food. There was no change in the remaining eggs; and when in August 1933 I opened one at random, it contained a healthy embryo, apparently in the same stage of development as in the previous winter. Unfortunately in September, during my absence from home, the dish was accidentally disturbed and the remaining eggs were desiccated and destroyed. These eggs had been incubating for 14 months, and but for this unlucky accident, there is no reason to suppose that they might not have continued in the same state of suspended development until the following spring. From the account of Butler (*Biology of the British Hemiptera-Heteroptera*) and judging from my own observations at Cley, the nymphs of *S. littoralis* occur from March until June, and the imagos for the four months, May to August. There are no records for other months of the year. From this it is reasonable to infer that eggs laid the previous summer hatch out in March or April, and that the duration of nymphal life is about two months. There is not sufficient evidence to determine whether any exceptional individuals hibernate; but the eggs must certainly overwinter in the mud at the edge of the tidal ditches in the marshes, and there must be subjected to all extremes of submersion, desiccation, heat and cold, during their eight or nine months of development. It would be interesting to know whether under unfavourable conditions in the open the eggs are able to pass over the usual time for hatching, and exist in a state of suspended development until the second spring comes round, as the behaviour of these laboratory specimens seems to suggest. Next summer it is hoped to obtain further material to test this possibility.

***Glossina* and Climate—Studies in the Laboratory.** By Professor P. A. BUXTON.

Investigations performed by the author and Mr. D. J. Lewis during 1933 at Gadau in the north of Nigeria were described. At this place and at Sherifuri, which is not far away, detailed studies of *Glossina morsitans* and *tachinoides* have been made in the field by Lloyd, Johnson and others. In the investigations which were described, an attempt was made to analyse the field observations by experiments in the laboratory in which temperature, humidity and opportunities for feeding were controlled. It appears that, by these experimental methods, a considerable advance could be made in our understanding of *Glossina* and, in particular, of the effect of climate upon wild populations of these insects.

The results of the investigations will be published at length elsewhere.

New or rare African butterflies. By Professor Hale Carpenter, M.B.E.

A new form of *Liptena rubromacula* Hawker-Sm. mimicking *Vanessula milca* Hew.

Four *additional* specimens were exhibited of the Lycaenid of which the first specimen was shown on 18 Oct. 1933. All were males.

These more recent specimens are from the same forest on the west coast of Lake Victoria, known as the Malabigambo forest, and were also received through the kindness of Mr. T. H. E. Jackson, F.R.E.S., who had collected them.

Since the first exhibit Professor Carpenter had seen a specimen of *Liptena rubromacula* Hawker-Sm. (1933, *Stylops*, **21** : 9) in the Joicey collection, and it was clear that Mr. Jackson's specimens, which all agreed in appearance, must be assigned to this species, although sufficiently distinct to receive a name. They may well be an eastern race, for the two Joicey specimens, both males, came from the Congo area.

It is proposed to call this new race **jacksoni** in honour of its discoverer, who has done much to increase our knowledge of East African Lepidoptera.

Liptena rubromacula jacksoni, forma n.

Differs from the type by the increased amount of orange on the fore-wing, and in considerable mottling of the underside of the hind-wing, by which differences a strong resemblance is produced on both surfaces to *Vanessula milca* Hew.

Fore-wing, upperside. The orange band extends forwards to cellule 5, whereas in the type the coloured spots are in cellules 1*a*, 1*b*, and 2 only, with a very slight suffusion in cellule 3. The band is also much wider, reaching a breadth of 4 mm. in cellule 1*b* where it is widest; the spot in cellule 5 is 2 mm. wide.

On the hind-wing, above, there is no difference in the shape and size of the orange area. On both wings, however, the colour is distinctly more yellow and of a less reddish-orange than in the type.

Under surface. The fore-wing shows greater breadth of the orange band than on the upper surface, it measures 5 mm. in cellule 1*b*, and 3 mm. in cellule 5. There is also a small orange spot in cellule 6 touching one on the costa, so that the band extends from costal to inner margin.

The black submarginal band is mottled along its outer edge from cellule 2 forwards with paler, yellowish, markings of which the largest are in cellules 6 and 7 : these are just visible in the type as minute paler spots in cellules 2, 3, 5, 6, 7, but not in cellule 4. A similar enlargement of minute paler markings is shown on the hind margin where there is a series of lunate pale yellowish markings, largest at the costal angle. The central paler band of the hind-wing is considerably paler than that of the fore-wing, and sends radiating streaks across the submarginal black.

Tips of antennae orange : in the type of the species they are missing.

Length of fore-wing, 15 mm.

Five specimens (type and paratypes) from Katera, Malabigambo forest, W. coast of Lake Victoria, Uganda. All males. T. H. E. Jackson, October, 1932 (2); November, 1933 (3).

Charaxes pythodoris pallida forma n.

The specimen exhibited was captured by Mr. Gerald Swynnerton, who kindly presented it to the Hope Department, Oxford University Museum. It was taken at Kazi-kazi station on the Central Railway in Tanganyika Territory, at an elevation of about 4000 feet, in October, 1932. The chief difference from other forms is shown by the light colour of the darker parts of the wing which instead of being deep black,

or brownish-black, is light brown. On the hind-wing the border is of more uniform outline proximally than in the other two forms in which it is narrower behind vein 7 and somewhat indented by the central blue; it is 9 mm. broad at vein 7, the same at vein 4, and 6 mm. at vein 2. The pale central parts of both wings are bluish-white, the amount of blue being very much less than in the other two forms. The blue is more decided on the fore-wing over the situation of the large black mark on the underside at the base of area 1*b*, and on the hind-wing in the cell and along the proximal edge of the dark border.

The pattern of the pale markings on the fore-wing is that of *p. pythodoris* rather than of *p. nesaea* Smith, but there is a triangle of pale blue filling up the basal angle of area 2.

The under surface is characterised by diminution of conspicuousness of the linear black markings, and a much lighter brown ground-colour. The large black marks on the fore-wing in area 1*b* are as in other forms.

A female of *Pseudathyma plutonica* Btlr.

The genus *Pseudathyma*, closely allied to *Euptera*, is of extreme rarity and very little known. Seitz names four species, which are represented in the National Collection by individual specimens. Mr. T. H. E. Jackson, F.R.E.S., kindly presented to the Oxford University collection a butterfly captured by him in November 1933 which he suggested was probably a *Pseudathyma*, and proved, by comparison with the male in the British Museum, to be the female of *Ps. plutonica* Btlr., strongly resembling *Neptis agatha* Stoll exhibited with it, and taken in the same forest.

All species of *Pseudathyma* strongly resemble *Neptis*, and their great rarity suggests that they are Batesian mimics.

Professor Carpenter said that in 1915 he had spent several months at a post in the same general locality as that in which Mr. Jackson had collected, namely the Malabigambo forest on the west coast of Lake Victoria in Uganda, and had even collected *Neptis* systematically and wholesale, without finding *Pseudathyma* among them, so that Mr. Jackson was to be congratulated on his good hunting.

Lachnocnema exigua Holl.

Four males and a female of this little-known species were captured by Mr. Jackson in the same locality as the last, and presented by him to the Oxford University collections. One male bore the date October 1932, the other specimens, November 1933. Seitz, somewhat quaintly, states that this species "is known only in the female" but gives a figure of the upperside of the male! The latter is uniformly brown on the upperside whereas the female has the greater part of the wings pure white, with a broad black margin. The female was sent by Mr. Jackson as one of a group of Lycaenidae of very similar appearance found in that locality, of which two species were exhibited with it: *Liptena confusa* Auriv. and *Pentila kirbyi* Auriv. The latter species is not uncommon, and it seems possible that it may be a model for the *Liptena* which is rare. The *Pentila* has a conspicuous black spot in the centre of the hind-wing which is less strongly shown in the *Liptena*, and absent in the *Lachnocnema*. Seitz gives the Ogowe and Kuilu Rivers, French Congo, as the

locality for *L. exigua* and its presence in Uganda is therefore of geographical interest. The species is represented in the National collection by a single female.

The male *L. exigua* being apparently little known, the following notes on its appearance are recorded. Upperside dark brown without markings, like *bibulus* F. The under surface has a light brownish-grey ground-colour, but on the fore-wings areas 1*a*, 1*b*, and 2 are paler grey. The apex of the fore-wing is of the same paler grey, while the posterior half of the cell is darker brown than the rest. There is an outer row of five marginal spots, black, with silver centre, one in each area from 2–6, and an inner, less well-marked row of two in areas 4 and 5, and sometimes a third in 6 very poorly marked. On the hind-wing there is a conspicuous patch of black, brown, and silver mingled, formed of two rounded marks in the cell and one at the base of 1*a* and 1*b* close to the others. Along the costa is a row of three brown spots, with silver spangling in between. Along the hind margin, from the anal angle to area 5, there is a series of silver-centred black spots, one in each area, and between this series and the dark patches in the cell and at the base of 1*a* and 1*b* is an irregular line of brown spots faintly spangled with silver. The margin of the wing is almost white at the ends of areas 6 and 7.

Evidence of attacks of birds upon butterflies. By Professor Hale Carpenter, M.B.E.

The following specimens bearing imprints of beaks, were exhibited.

(a) *Lachnocnema exigua* Holl.

One of the males mentioned above. The right fore-wing has the apex missing, and the torn margin rubbed. Two separate marks project forwards and inwards from the anal angle, in slightly different directions: that pointing most to the centre reaches the costa, and is the clearest. It agrees in shape and size with fig. L, plate 1, of 1933, *Trans. R. ent. Soc. Lond.*, **81**; and is equally well shown on both surfaces of the wing.

(b) *Acraea bonasia banka* Eltr. (Acraeinae).

A male captured by Mr. (now Sir Arnold) Hodson in S.W. Abyssinia 15 Jan., 1925, at Humo in Maji Province. It has evidently been seized when at rest, for the mark is clearly defined on the left fore- and hind-wings, and can be more faintly seen on the right wings in corresponding positions. The mark is more slender than in the last case, and corresponds to fig. X on the plate mentioned. The mark on the fore-wing projects forwards and inwards from the anal angle into the cell, and on the hind-wing forwards from the wing-margin at vein 2.

(c) *Charaxes zoolina neanthes* Hew. (Nymphalinae).

A male: by the same captor in S.W. Abyssinia on 30 September, 1925, at Tirma, at an elevation of 3900 feet. The outer edges of both fore-wings are cut off, more cleanly on the right than the left, and on the right side a mark projects inwards from veins 3 and 4 to the anterior angle of the cell. The mark is less clearly defined than in other cases and there is a good deal of rubbing around it: it corresponds with fig. F on the plate mentioned. It is very clearly shown on the under surface.

(d) *Neolycaena cissus* Godt. (Lycaeninae).

Also from S.W. Abyssinia, taken by the same captor at 6000 feet below Gore, on 18 December, 1926. Two long, slender marks on the right fore-wing project forward from the anal angle, the outer mark being shorter and less well-defined.

They are faintly visible on the under surface. In character they agree with the figure of the mark made experimentally by a Bee-eater's beak on the plate mentioned.

(e) *Hirsutis megara* Godt. (LYCOREINAE).

A male captured in August 1917 in Trinidad, W. Indies, and presented by Mrs. H. Turner. There is an extraordinarily clear impression on the left fore-wing, extending from the anal angle forwards to the end of the cell where it ends in a small circular puncture. Through the kindness of Dr. Percy Lowe, of the British Museum, it had been possible to identify with a fair degree of certainty the type of bird that had made the attack, as *Myiarchus ferox* Bartlett (TYRANNIDAE), the imprint of the beak of which, on soft paper, corresponds very closely to the impression on the wing, with the same puncture at the angle.

Wednesday, 21st March, 1934.

Dr. S. A. NEAVE, O.B.E., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society :—The Rev. A. H. MAURICE T. BECKETT, O.B.E., The Presbytery, 42, Cranleigh Villas, Kenton, Harrow, Middx.; KRISHNA BEHARI LAL, Chandra Bhawan, Azamgarh, U.P., India; M. R. CHAKRATONG TONGYAI, Department of Entomology, Cornell University, Ithaca, N.Y., U.S.A.

Exhibits.

The following communications were then made.

The " Danske Atlas " of Bishop Erich Pontoppidan. By A. W. MCKENNY HUGHES.

The Society has recently purchased for its Library a copy of Volume I of Pontoppidan, E. " Den Danske Atlas, eller Konge-Riget Danemark," &c. 1763. Since this work is of great rarity and but few copies are known, the following remarks concerning its author are possibly not without interest.

Bishop Erich Pontoppidan was born at Aarhus in 1698 and died in 1764. He studied Theology at the University of Copenhagen and, after ministering to the needs of several parishes of Sleswig and Holstein, was appointed Chaplain to the King of Denmark in 1735. Three years later he became Professor of Theology at his University, to become Chancellor in 1755, having, in the meantime, been appointed Bishop of Bergen in 1747.

Pontoppidan was a member of the Royal Society of Copenhagen and the Imperial Academy of Sciences of St. Petersburg.

He wrote extensively on Theology and Archaeology besides his well-known works on the Natural History of Norway and of Denmark.

It was during a stay in Norway that his early taste for Natural History and Archaeology was developed, which resulted in his work on the Natural History of Norway. This work, an English translation of which is in the Library, is to-day mainly of interest by reason of the accounts of " Mer-men " and " Sea-serpents," which the author not only describes and endeavours to prove to be of physical existence in Norway, but gives two amusing, if highly improbable, figures to justify his statements.

This work was followed by the much more ambitious " Danske Atlas." This is the first attempt at a description of the whole of Denmark, and is still considered by many to be the most important topographical work in Danish literature. Volume I, which is the volume more immediately under consideration, contains the account of all the natural products of the country including the animal kingdom, which occupies a substantial part of the volume. The lists of animals contain many additions to the Danish Fauna, and several species are described here for the first time. It is believed that Pontoppidan received some assistance from Brünnich in the preparation of the list of insects and also from Capt. Teilman, a very keen collector of the period, and a number of species described by Brünnich in his " Prodromus insectologiae siaellandicae," 1761, are figured by Pontoppidan in his work for the first time.

Perhaps naturally, in view of the immensity of the work, much of the book is mere compilation, but its effects on the science of its time were great and lasting. The only other copy of the original work which has so far been traced in London is a complete copy of the 7 volumes in the British Museum Library at Bloomsbury, which came from the Sir Hans Sloane Library. I am indebted to the Registrar for my facts.

A film of the American Purple Martin, showing its fearlessness of man in conditions of complete freedom and the validity of feeding experiments with insects. By Prof. Poulton.

Prof. Poulton communicated the film showing the Purple Martins (*Progne purpurea* L.), referred to in our 1933 *Proceedings* **8**: 96–97, and kindly presented by Miss E. A. Oehlenschlaeger to the Hope Department, Oxford University Museum. The tameness and freedom of the birds, which had fallen or been turned out of their nests and had been adopted by man, was very evident in the pictures, and led to the conclusion that their food preferences, as described in the 1932 (1933) *Proceedings*, **7**: 98–100, were entirely natural. The description of the young Martins' behaviour was quoted from letters kindly written by the donor. All the photographs were taken in 1931, at the " Hummocks," Milwaukee, U.S.A.

The first picture showed the tameness of a single Purple Martin which fell out of a nest in the house colony on 10 July, 1931. " Without any effort on our part it adopted the entire family for two and a half days, accepting any insects which we could catch and helping itself to all it could find—always on the lawn. When we stepped out-of-doors the bird would promptly fly towards us and always alight directly at our feet. It loved to get under a sprinkler on the lawn for a good shower-bath and would then settle on some point of vantage to preen. About the middle of the third day it simply flew off with the rest of the colony birds." The film showed this bird on the shoulder and head of Miss Oehlenschlaeger's young friend John Taylor—moving about and freely accepting his caresses.

The following section photographed 13 September shows one of the " Martin Quartet " * flying to Miss Oehlenschlaeger's hand and feeding from a dish on the

* Described in *Bird-Lore*, **34**: 245–252, July–August 1932; also, with further details concerning the insects accepted and refused, in 1932 (1933) *Proc. ent. Soc. Lond.*, **7**: 98–100.

table. " This picture was taken two days before the bird migrated. It shows so charmingly the ' begging '—the wings in motion and the beak stretched wide open for a worm."

" The next group, taken 15 August, shows Mr. Taylor with the entire quartet. It does not need much explaining. The birds are eating, drinking and bathing, and to us all it has an irresistible charm—in addition to proving their entire freedom."

" The last group on the film was taken about 2 August and shows ' Lindy ' alighting out of the blue on my arm, and the ' Baby,' important small person that it always was, running along the awning as fast as it could to some worms held out to it."

Prof. Poulton wished in conclusion to thank Mr. K. Morris for kindly projecting the film with his apparatus.

Further instances of " homing " in Lepidoptera. By Prof. Poulton.

Prof. Poulton said that his friend Mr. W. Parkinson Curtis, F.R.E.S., had kindly directed his attention to an observation by E. A. Fitch, well remembered by him as one of our Secretaries in 1884 when he joined the Society. Mr. Fitch recorded (21 March, 1882) in the 1882 *Entomologist,* **15**: 91, under the heading " Fixity of Tenure by a Moth," that a specimen of *Taeniocampa gothica* L. had " for the last three days . . . occurred in a similar position outside one of the window-frames of my dining-room." He added that the resting position was " unoccupied each evening when presumably the moth was absent on business." Also that it was not there on the day when he wrote.

In the same note Mr. Fitch referred to an observation made by M. C. Piepers in the Proceedings of the Dutch Ent. Soc., **19**—a paper translated by W. F. Kirby and published with the title " On the Habits of East Indian Insects, especially Lepidoptera," in the 1877 *Entomologist,* **10**: 266. On p. 270 of this translation Piepers records the fact that a specimen of the Nymphaline butterfly *Precis iphita* L. was seen by him resting on the strongly illuminated ceiling of the open verandah of the Harmonic Society at Manghasar. The insect was absent next day, but again at rest on the ceiling in the evening and later on; for Piepers " had the pleasure of admiring the memory of this *P. iphita* for six days. It was not to be found in the daytime, and was then probably absent on business; but every evening, for six consecutive evenings, I found it returned faithfully to the same sleeping place. Then some accident probably befel[l] it, for I never saw any trace of it again."

These observations were an interesting addition to the two quoted in our 1933 *Proceedings,* **8**: 13, 14.

A film showing entomological excursions in West Africa.

Mr. K. R. S. Morris (a visitor) showed a film made during a recent journey in West Africa with special reference to the Tsetse country and also showing locusts swarming.

Wednesday, 4th April, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Exhibits.

The following communications were made to the meeting :—

The Bed-bug. By A. W. McKenny Hughes.

The Hon. Secretary exhibited a short film which had been taken in the slums of London to explore the possibility of producing a film of the Bed-bug for propaganda purposes. The results encouraged one to believe that, given improvement of technique, such a film is possible.

He then dealt with some aspects of the Bed-bug problem. The moving of tenants from infested slum areas to new housing estates provides no practical difficulties. The furniture can be fumigated in transit, in pantechnicons, by means of hydrocyanic acid gas, thus ensuring that it is free from Bed-bugs on arrival at the new house. In certain schemes the tenants themselves are taken to a disinfecting station, where they have baths and their clothes are fumigated. On the other side of the picture we find houses which are infested but not scheduled as a clearance area and from which there is no chance of moving the tenants; these areas are many and widely distributed throughout the country. Many large districts in London and the provinces are little short of 100 per cent. infested. Many remedies have been suggested for dealing with infestations in houses—sulphur, sprays and the like, but none of them can claim complete efficiency. Up to the present time the danger of using hydrocyanic acid gas in crowded areas, and the time necessary to complete the fumigation of a house by the ordinary method, have proved insuperable barriers to the common use of this fumigant, though no one doubts its efficiency. A new technique for the use of hydrocyanic acid gas has been evolved and is at present being tested—namely the use of a hot-air blower before and after treatment. If this method is successful, the whole operation of clearing a house should be accomplished in eight hours as opposed to the usual twenty-four, and if carried out by experts, should be possible without risk. Various other insecticides known to be toxic to Bed-bugs are being experimented with, but so far none of them has been entirely successful.

The Hon. Secretary emphasised the need for education and for a cleanliness campaign. He pointed out that regular inspection by nurse-inspectors had proved extremely successful in certain parts of the country, and that the tenants themselves had been taught to recognise the different stages of the insect, and to eliminate them by the use of scrubbing brush, hot water, soap and soda. He suggested that if a large scheme of fumigation was under consideration it was essential to run a cleanliness campaign concurrently, since it is useless to expend large sums on the eradication of Bed-bugs if the chances of reinfestation are not reduced to a minimum. Education of the tenants in the habit of cleanliness, in the dangers attendant on the purchase of secondhand furniture, in the recognition of the early stages of the bug and of signs of infestation, are all essential, if this pest is to be exterminated. Cleanliness must be the foundation on which all schemes are built.

Some Histological Changes during Moulting. By Dr. V. B. Wigglesworth.

Some of the changes that occur during moulting in *Rhodnius prolixus* (Hemiptera) were described. Only one meal of blood is needed by this insect in each stage; moulting takes place at a definite interval after each feed. The epidermal cells first separate from the cuticle and multiply rapidly by mitotic division. When this process is at an end, they lay down the non-chitinous *epicuticle*, composed of the material called "cuticulin," and then secrete below this the *endocuticle*, composed of a mixture of protein and chitin. The inner third of the endocuticle is not developed until after moulting. The bristles are formed by trichogen cells; these give out processes, which pass through annular "tormogen" or socket-forming cells, and later become chitinised and impregnated with cuticulin. Meanwhile the moulting glands pour out the moulting fluid which fills the space between the new cuticle and the old. This fluid appears to contain digestive enzymes, a protease and a chitinase, which dissolve the old endocuticle; the products of digestion being absorbed through the general surface of the insect, and presumably used again in the formation of the new cuticle. In this way, nearly 90 per cent. of the substance of the abdominal cuticle may be reabsorbed before the old skin is cast. The moulting fluid attacks only the endocuticle; when the insect moults it sheds little more than the epicuticle, upon which the fluid has no action.

A full account of these observations is published in 1933, *Quart. J. micr. Sci.*, **76**: 269–318.

Papers.

The following papers were read:

(1) "The male and female genitalia and the biology of *Euchalcidia caryobori* Hanna," by A. D. Hanna.

(2) "New Exotic Hydroptilidae," by M. E. Mosely.

(3) "Spiral and other anomalous forms of segmentation with an account of three ventral spirals in one brood of *Hadena dissimilis* Kn.," by E. A. Cockayne.

(4) "On some further remarkable structures in Trichoptera," by H. Eltringham.

(5) "Übersicht der orientalischen Gattungen und Arten des *Carcelia*-Komplexes. (Diptera—Tachinidae)," by N. Baranov.

Wednesday, 2nd May, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Election of Fellow.

The following was elected a Fellow of the Society:—

Leonard G. Hulls, Rax, Chidham, Near Chichester, Sussex.

Obituary.

The death of Mr. J. B. Hicks, a Fellow of the Society, was announced.

Exhibits.

The following communications were then made to the meeting:—

Replies to Dr. W. L. McAtee's Rejoinder in Proc. Roy. ent. Soc. Lond., **8**: 113–126, to Papers on Protective Adaptations Published by the Society (*loc. cit.* **7**: 79–105).

The replies follow the order adopted by Dr. McAtee. The statements of authors unable to be present were communicated by Prof. Poulton.

Dr. McAtee and "Relative Acceptability" (8 : 113–116).

Dr. Frank Morton Jones, who was unable to be present, sent the following reply :—

In criticism of my recent paper (*Trans. ent. Soc. Lond.*, **80**: 345–385) on "Relative acceptability of insects to birds," Dr. W. L. McAtee (*Proc. Roy. ent. Soc. Lond.*, **8**: 113–116) says, "As a matter of fact none of the 8 species which Dr. Jones lists as contributing most to his records is a preponderantly insectivorous species." This statement, with its intended implication that the food-habits of these eight bird species detract from the significance of the experiments, gives an erroneous impression of fact, even as presented by Dr. McAtee and his associates of the Biological Survey. Dr. McAtee himself (in "The Relation of Birds to Woodlots," 1926) stresses the economic value of most of these birds as destroyers of injurious insects, and in his enumeration of the percentages of animal matter (chiefly insects) in their food, credits the Brown Thrasher (p. 82) with 64 per cent. animal food; the Catbird (p. 78) with 44 per cent.; the Robin (p. 93) with 40 per cent.; the Song Sparrow (p. 62) with 33 per cent.; the Chewink (p. 64) with 30 per cent.; and he even permits himself to speak with enthusiasm (p. 50) of the Blue Jay as a notable destroyer of injurious insects.

From other publications for which Dr. McAtee's associates in the Biological Survey have been responsible and of which he is fully aware, it is apparent that in the summer season the percentages of animal (insect) food of some of the eight bird species are materially greater than those just enumerated. For example :—

Song Sparrow, 1901, Bull. U.S. biol. Surv. **15**: 84—"Insects . . . from May to August, inclusive, when they are eaten most freely, compose more than half the food."

Grackle, 1900, Bull. U.S. biol. Surv. **13**: 60—"Insect food . . . steadily increases till May, when it reaches its maximum of five-eighths of the whole." Further tabulations in the same publication indicate that more than 50 per cent. insect food is eaten in May and June, over 40 per cent. in July.

Brown Thrasher, 1913, Frmrs'. Bull. **513**: 11—". . . insects, which constitute more than 60 per cent. of its food."

Cowbird, 1900, Bull. U.S. biol. Surv. **13**: 24–25—". . . the animal food consists almost entirely of insects and spiders." Tabulations follow, showing insect food to constitute nearly 60 per cent. for June, over 50 per cent. for July and August.

That is, several if not all of the eight bird species utilised in my experiments *are* predominantly insectivorous *at the season of experiment* ("mid-June to early September"), and in this connection the statement of their habits to the contrary could not have been more misleading had it been literally and entirely untrue.

Though we are told by Dr. McAtee that none of these birds feed upon adult Lepidoptera to "as much as 2 per cent. of their total diet" (at what season?), yet

he omits Lepidoptera from further consideration for the added reason that in the Survey's records of stomach contents, "identification of these insects to species is so seldom carried out." In the experiments these birds showed themselves just as ready to accept moths as beetles, and just as consistent in their refusals of a large percentage of the more gaudily coloured insects of both groups, in contrast with their ready acceptance of those of duller colours.

Dr. McAtee states that "selection of food items in experiments always is to some degree that of the experimenter." In my experiments, selection of food available *was* that of the experimenter; but the choice from this, of items for refusal, *was the selection of the birds*; and that selection, consistently repeated many times over, was the more significant for the fact that it was made from an abundant and varied supply of other items which were readily accepted.

Dr. McAtee compares my table of insects used in experiments (my pp. 381–385) with the Biological Survey records of these same insects as identified in the stomachs of Nearctic birds. Whatever may be the significance of his figures, based upon "times identified" in the stomachs of *all* Nearctic birds, they offer no evidence against the phenomena I record in the behaviour of eight species of birds. On his own basis, his results would have been very different, had he not omitted two items (*Phyllophaga* and *Polyphylla* [p. 382], *Cantharis* sp. [p. 384]) from his tabulations of Sections I and II, while including three similar items (*Chrysopa* sp., *Ophion* sp. and related, *Bombus* sp. [p. 385],—identifications to genera, not to species) in Section III.

How completely deceptive is any attempt to compare figures on his basis and mine (mine based on numbers of insects used, his on numbers of times identified) may be illustrated by an example from his tabulations, where a single species, *Harpalus caliginosus* Fab., is credited with nearly forty per cent. of the total number of units for Section III; for *if every one of the eighty thousand stomachs* studied by the Biological Survey had contained this insect, that fact would not have invalidated the conclusions based upon my experiments; for not in anticipation of any such use of these tables but as a statement of obvious fact, in my 1932 paper (p. 353) I pointed out that this and four other species were each used only once—single insects among five thousand others—hence stating that their "low rating may well be purely accidental." In this light, Dr. McAtee's tabulations of Section III lose their assigned significance.

In recognition of this fact, that the significance of the assigned rating of any given species hinges upon its use, in competition with other fairly comparable insects, in sufficient numbers and frequency to eliminate or reduce the element of chance, I gave separate consideration (pp. 357–363) to a number of insects whose records seemed to meet that requirement. If Dr. McAtee will compare the eight beetles with his own tabulations, he will find that by his figures their record per species is not 26·76, but 2·25.

With final reference to Dr. McAtee's tabulations, these are based upon my pages 381–385, where I enumerate all the insects of all orders, used in my experiments; but *these are not the tabulations* from which I deduced the influence of coloration on relative acceptability. On an early page (346) of my paper I stated that in so far as it should prove possible it was my endeavour that "each included species should be in competition with some others of like size and general character,

and of proven acceptability." Following that principle, on pages 350 and 352 I brought together for comparison in tabular form *all the moths* and *all the beetles* (including only two insects of other orders), a total of more than four thousand insects of nearly two hundred species, and from that tabulation presented evidence of the influence of coloration on relative acceptability. That is, I intentionally excluded from the tabulation Neuroptera and Hymenoptera, which in every experiment showed themselves relatively unacceptable to these birds, with (for many of them) coloration not the deciding factor.

Dr. McAtee asks, "Why experiment?" Stomach examinations show what a bird has eaten, and may show in what quantities eaten; but they do not show from what insect population that selection was made. On a feeding-tray, a known insect population is sorted out by the bird in accordance with its preferences, refusals are not determined by numbers or availability, and the basis of these refusals is sometimes and in some degree determinable.

As Dr. McAtee points out, experiments usually do include some departure from natural conditions; but as he himself has said (1932, *Smithson. miscel. Coll.* **85** (7): 140), "The experience we have when we place inviting food supplies in abundance before the birds indicates what must happen in nature under similar circumstances."

Rejoinder (Proc. 8 : 116, 117) to Prof. E. B. Poulton (Proc. 7 : 80–86).

Prof. POULTON communicated the following reply :—

In his rejoinder to my contribution (**7 :** 80–86) to the discussion of 7 December, 1932, Dr. McAtee alters the material of the bags enclosing the caterpillars from "muslin" to "cloth," and thus having transformed a considerable measure of visibility into complete invisibility, proceeds to base the following adverse conclusion on this fictitious quality :—"If the birds pecked into some and devoured the contents and ignored others, it would appear that some quality other than colour gives the 'protection' and that unusual coloration would therefore be unnecessary to their defence" (p. 116).

Of course the protection is given by "some quality other than colour"—in the *grossulariata* larvae by distastefulness to insect-eaters, as has been proved again and again. The conspicuous pattern, warning of this distastefulness, would certainly be visible through the coarse muslin to the sharp eyes of a bird. Furthermore, the number of larvae thus compelled to be gregarious would probably advertise their unpalatability to an enemy with a highly developed sense of smell. The fact that procryptic caterpillars were detected and devoured wholesale by birds and wasps while conspicuous ones, kept in the same kind of bag in the same garden, were neglected will not be ignored as seeming "of little value in this field," by an unbiased naturalist.

The words "How different would be the fate of procryptically coloured insects crowded in a small area——" referred to the gregarious habits of the conspicuous black and red Burnet moths (p. 81) and would be equally applicable to the companies of Buff-tip caterpillars mentioned on the following page. To this McAtee replies that certain insects which he considers to be procryptic *are* gregarious, giving such instances as "grey Psocids in patches on tree-trunks" or "swarms of Chironomids" and "winter-crane-flies" on the wing—instances which are in

no way comparable with Burnet moths "often crowded in a corner of a field or common—conspicuous in flight or at rest," or the "Buff-tip caterpillars advertising their presence by the conspicuousness of their massed colours, and also by the expanse of leafless twigs around them." The gregarious habits associated with courtship or with other epigamic or social behaviour are well known and are very different from the aposematic display of the Burnet moths and countless other examples. Of much interest in this connection are the relatively rare examples of a cryptic effect brought about by clustering.*

As regards the stick-like Geometrid larvae it is convenient to recall McAtee's original criticism † of my statement ‡ and that made by P. G. Howes.§ The *specialised stick-like larvae* of GEOMETRIDAE, and these alone, are referred to in our words quoted by Dr. McAtee when he replied that "such a defense depends upon immobility whereas these caterpillars must be in motion the greater part of the time while searching for and devouring food" (p. 58). Confronted by the statement that these caterpillars move about to feed at night and are enabled by various adaptations to remain still and rigid by day (*Proc.* **7** : 84–6), he shifts his ground to Geometrid larvae generally and especially mentions the "cankerworms" which are not of the stick-like type and appear to resemble our British species of *Hybernia*.‖ I have had a long and wide experience of our stick-like Geometrid larvae, and all I have bred or observed in the field have been—unless disturbed or subjected to unnatural conditions such as overcrowding—invariably rigid and motionless during the daylight hours. There are occasional failures in the adaptation, although I do not remember one ; but my friend Miss Balfour, who has keenly observed caterpillars for many years, informs me that "the stick-like larvae sometimes turn the wrong way, and then of course betray themselves at once. I have several times found them in this reversed position." Such a failure as this is, of course, very much less than the complete abandonment of rigidity which Mr. J. R. Malloch ¶ believes he has often observed. The "selectionist," so much despised by McAtee, will conclude that any such partial or extreme failures of instinct are prevented from rising to dangerous proportions by the operation of the Darwin–Wallace principle.

Although, as stated above, I was not referring to the "cankerworms" or to any except the highly specialised stick-like Geometrid larvae, the following statement in a letter from my friend our Hon. Fellow, Dr. L. O. Howard, is of so much interest in relation to the attacks of birds upon insects that I am sure the Society will be glad to have the opportunity of reading it :—

* The African homopteron *Flata nigrocincta* Walk. is an interesting example illustrated in the late Prof. J. W. Gregory's "Great Rift Valley," Lond., 1896, and later by S. L. Hinde in *Trans. ent. Soc. Lond.*, **1902** : 695, pls. xxvi, xxvii; also possibly the caterpillars mentioned in 1932–33 *Proc.*, **7** : 47 and footnote.

† "Effectiveness in nature of the so-called protective adaptations in the animal kingdom, etc.," 1932, *Smithson. miscel. Coll.*, **85**, (7) : 53, 58 (quoted as "85" on p. 53).

‡ "Colours of Animals," Lond., 1890, p. 26.

§ "Insect behavior," 1919, pp. 164, 165.

‖ This conclusion is suggested by the description and figures of "The Spring" and "The Fall Canker-worm" in W. J. Holland's "Moth book," N.Y., 1903 : 324, 326, pl. xlii, figs. 25, 26.

¶ In the courteous letter by which Mr. Malloch replied to my inquiries, he wrote :—"I was not thinking of the stick-like forms only and I rather fear that there is such a gradual gradation from such types in their more marked forms to those of much less stick-like type that any general rule cannot be applied to them." But it was only to the "more marked forms" that I referred.

11 *Jan.*, 1934.—" You may be interested to know that back in the 1860's and early 1870's cankerworms were a real pest in most of our northern cities and villages, and also to a much lesser extent in the orchards. I remember as a boy very well that they were active in the daytime on the shade-trees in Ithaca, N.Y., and that they were constantly spinning down to such an extent that passers-by nearly always had to brush them from their clothing before entering houses.

" So much for their daytime activity. Now as to birds : The English sparrow was brought over to this country largely to destroy the cankerworms, and as it increased and spread it did destroy them. They are no longer considered a pest and have not so been considered for many years, and I attribute this practically entirely to the English sparrow. *But*, after a number of years, the so-called white-marked tussock moth (*Orgyia leucostigma* F.) accommodated itself to urban life and became from time to time a serious shade-tree pest. The larva of this species, being very hairy, was not eaten by the English sparrow; and the birds that would eat it, namely the vireos and their relatives, were speedily driven from our towns and cities by the English sparrow. I have reviewed this briefly in a bulletin entitled ' A Study in Insect Parasitism.' " *

Dr. McAtee, on p. 116, quotes two short sentences from a very interesting paper by R. T. Young.† As the first of these sentences treats of the essential importance of stillness in protective resemblance and the second, taken by itself, gives a wholly false impression, I have reproduced below the author's statement, on p. 498, of his conclusions based on *the whole* of the evidence :—

He describes " The purpose of the experiments [as] being . . . to ascertain whether or not protective resemblance in the case of motionless animals is really an efficient means of protection to them.

" This latter question has I believe been answered in the affirmative by these experiments. I have endeavoured in them to put to an experimental test a hitherto practically untested hypothesis."

The author is mistaken in this last sentence, for the researches conducted in 1898 and referred to by Mrs. C. B. S. Hodson (*Proc.*, **7** : 90) were devised and carried out in order to provide such an experimental test (see p. 28).

R. T. Young's " Final Summary," printed on p. 499, is as follows :—

" 1. Protective resemblance is effective in protecting motionless animals from attacks by caged birds.

" 2. Stillness is probably a more important factor than color in protecting animals from their foes."

I entirely agree with the general truth of this last opinion. All the various co-ordinated elements of function and structure which combine to produce the cryptic resemblance of a specialised stick-like Geometrid larva would be useless without stillness, and I believe that any naturalist who will make a special study of *these* caterpillars will find, as I have done, that their behaviour is not such as to destroy the whole meaning and value of the cryptic resemblance, and especially of those very contrivances by which a prolonged rigidity may be maintained.

* 1897, *Bull. U.S. Div. Ent.* (*Tech. Ser.*), **5**.
† " Some Experiments on Protective Coloration," 1916, *J. exp. Zool.* **20** : 457–499.

Rejoinder (8 : 117–119) to Prof. R. A. Fisher (7 : 87–89).

Prof. R. A. Fisher, F.R.S., who was unable to be present, sent the following reply :—

In commenting on McAtee's criticism of the theory of protective adaptations, at a meeting of the Entomological Society, it appeared to me that a major cause for disagreement lay in that author's conviction, which he had evidently cherished for many years, that his tabulations of species identified in birds' stomachs had an important, and even a conclusive, bearing on the theory he was discussing. This belief seemed to me to rest on a logical fallacy, which could be recognised by stating what observable facts the theory really implies, and by noticing that these had no point of contact with the facts reported by McAtee.

In his reply McAtee appears at first to admit that the criticism was well directed. He asks the disarming question, "The treatment of the subject has been highly speculative, so why blame McAtee for throwing no light upon the question?" I should explain, therefore, that I did not criticise McAtee for throwing no light upon the question, but for putting forward a large mass of irrelevant data, and for stressing in the strongest terms its supposedly decisive value.

Again, I noted the abundant use of the saving words "approximately," "practically," and the like, not that they seemed inappropriate to the vague statements which they qualified, but because statements, requiring such qualification at every point, are inadequate to establish the quantitative conclusion which McAtee claimed to have established; namely, that the evidence he had to offer showed that predatism was determined by abundance to *such an extent* as to exclude selective feeding habits. Dr. McAtee explains that he has been taught, and continues to believe, that employment of such saving words is the mark of a scientist. I shall merely suggest, therefore, that when he uses them the scientist should also appreciate the limitations that they exist to convey.

On the question "*How* largely predators must be guided in the choice of food by availability, so as practically to ignore protective adaptations," McAtee repeats that the degree to which they were shown, in his Smithsonian paper, to ignore protective adaptations, creates a presumption of indiscriminate tendencies. Here the cart is put before the horse. The Smithsonian paper claimed to show that availability was so important that protective adaptations could not be effective. The paper only showed that abundance was an important factor. From this fact the illegitimate inference was drawn that other factors must be unimportant. The paper did not pretend to supply any direct measure of the importance of protective adaptations, and it is only researches directed to this end that can have any logical force.

Finally, it may be worth while to comment on the statement that "selection" merely means death before reproduction. This embodies a fallacy far more widely held than the others we have been discussing. Selection embraces every factor which causes one type of individual to be more largely represented than another in future generations. It includes differential mortality before and during the reproductive period. In plants it includes partial death, or the dying back of

parts, and also the differential growth by which one plant may become larger than another. It includes differential fertility during the reproductive period, which in man and the domestic animals is known to be a very important factor indeed. It includes resistance to debilitating diseases, over and above their effect on the death-rate if they adversely affect reproduction, or, for example, lactation in mammals. In the case of the social insects the factors which influence the representation of the germ-plasm in future generations must often be still more indirect.

Rejoinder (8 : 119, 120) to Sir Guy Marshall (7 : 89, 90).

Prof. POULTON communicated the following brief reply to Dr. McAtee's criticisms. His friend Sir Guy Marshall, who was unable to be present, had seen the manuscript and had expressed his agreement.

Dr. McAtee, in his reply, implies that Sir Guy Marshall had maintained that ant mimicry does not exist in the Nearctic Region. This is an incorrect interpretation of the statement :—" ant mimicry finds its highest development in the tropics, where ants are a dominating feature of insect life, but it is a comparatively rare phenomenon in the North Temperate Zone . . ." (p. 89). He then quotes Sir Guy Marshall's sentence on page 90 :—" McAtee tacitly assumes that all ants are supposed to be protected from attack, an assumption that is entirely without warrant "—and continues that he " is really glad to have this admission but wonders whether the other selectionists will abide by it "—an entirely unnecessary and baseless doubt.

Dr. McAtee then attempts to justify his assumption by quoting words of mine which conclude with the statement that certain species of insect-eating animals " are adapted to feed almost exclusively upon " ants.* McAtee does not appear to realise that he is bringing forward the obvious disproof of his own assertion as the evidence in favour of it.

As regards the later paragraphs of Dr. McAtee's rejoinder, I may refer to my paper " Ants as models for mimicry " † in which it is shown that it is unsound to argue " because ants have many enemies [therefore] the resemblance to ants cannot protect against enemies."

Rejoinder (8 : 121) to Mr. H. St. J. K. Donisthorpe (7 : 90).

Mr. DONISTHORPE, who was unable to be present, sent the following reply :—

Dr. McAtee quotes or rather misquotes me as saying that I had " no evidence of birds capturing worker ants." My words were :—" Personally I have never seen a bird in this country capture worker ants in the field, though I have seen the long funnel-shaped holes in the nests of *Formica rufa*, L., made by the green woodpecker to get at the ants in winter " (*Proc.* **7** : 90). This sentence supplies

* From an address to the Fifth Internat. Zool. Congr., Berlin, 15 Aug., 1901 (*Verh. Int. zool. Congr. Berlin*, 5, 1902, p. 171).

It seems worth while to quote the following sentence from *Trans. ent. Soc. Lond.*, **1903** : 573 :—

" All animals with warning colours have enemies, all are liable to special attacks, in times of exceptional hunger, by enemies which would at other times neglect them."

† 1929 (Wasmann-Festband), *Zool. Anz.* **82** : 79–86.

circumstantial evidence of attacks on the workers. Furthermore, the statement "that worker ants are in general well protected" obviously implies that their protection may fail, although, as may be inferred from my remarks, to nothing like the same extent as that of the winged forms.

Shortly after the meeting of June 6 Prof. Poulton received a courteous letter from Dr. Walter E. Collinge informing him that the twenty-two species of British birds, recorded on his authority as "ant-eating" by Dr. McAtee (p. 121), were given in answer to a request for "a list of birds in whose stomachs" he had found ants. In sending the list Dr. Collinge had stated that "the species which eat the largest percentages are the Woodpeckers and Partridges." Dr. Collinge had now kindly given Prof. Poulton the names of those birds out of the twenty-two which he looked upon as ant enemies :—

"The frequent occurrence of ants in varying percentages in the ten following species leads me to regard them as ant enemies :—corn-bunting, sky-lark, robin, hoopoe, all three woodpeckers, partridge, red-legged partridge and grouse. These species show a distinct preference for ants, the remaining twelve eat them only occasionally." Dr. Collinge furthermore distinguishes between the first three birds and the others :—"The corn-bunting, sky-lark and robin evidently show a preference for ants, but the occasions when they occur in the stomachs are comparatively few, although the percentage is high. I should say they are not regular enemies like the woodpeckers, partridges and grouse, but when they meet with ants in large numbers they evidently show a preference for these insects."

Dr. Collinge had also sent the following more detailed information concerning the seven species which he regards as regular enemies of ants :—

"*Hoopoe*—the few specimens examined have contained large numbers of both workers and winged forms.

"*The three woodpeckers*—eat ants all the year round in my experience—workers mostly, but winged forms also.

"*The two partridges and grouse*—eat ants, April to October,—workers mostly, but winged forms also."

The above interesting and valuable information affords a good example of the conclusions which may be drawn when a subject is approached in the spirit of the naturalist rather than by Dr. McAtee's mechanical and unscientific method of lumping all records, large or small, regardless of their widely varying significance.—E. B. P.

Rejoinder (8 : 121) to Mrs. C. B. S. Hodson (7 : 90).

Prof. Poulton replied on behalf of his friend Mrs. Hodson who was unable to be present but had expressed her entire agreement with the following brief statement :—

Dr. McAtee, referring to the conclusions "that sight is important to enemies in discovering the pupae [of *Aglais urticae* L.], and that conspicuously exposed specimens were most freely preyed upon," maintains that they "offer nothing that is opposed to the arguments" of his paper. The opposition was to his confident assertions rather than arguments—such assertions as those made concerning

the leaping Orthoptera :—" Despite persecution, these insects abound and the reasons are high fecundity and the great surplus of food available to them; these are substantial realities and outweigh immeasurably those airy intangibilities classed as protective adaptations." * If the protective adaptations of the pupae were proved to be advantageous, as McAtee appears to admit, why should the same methods count for nothing in the life of a grasshopper?

Rejoinder (8 : 121–123) to Mrs. M. D. Brindley (7 : 91–94).

Mrs. Brindley communicated the following reply :—

Dr. McAtee's reply to my criticisms consists for the most part of generalities on which it is difficult to comment.

p. 121.

Paragraph 2. I am still not convinced that the number of species in a group is necessarily a fair index (or in many cases even a rough one) of the absolute abundance of individuals. In this connection, attention might be drawn to some results of insect trapping in the U.S.A., published in a paper by Samuel S. Graham on " The Influence of Civilisation on the Insect Fauna of Forests in North America " (1933, *Ann. ent. Soc. Amer.*, **26** : 497–528). However, if Dr. McAtee thinks that the assumption helps the case, I am ready to agree that perhaps there may be more individual soil Protozoa, Nematodes and even Chironomids on the globe than there are ants.

p. 122.

Paragraph 1 contains another attempt to smother us with those " thousand type-written sheets "; and the writer goes on to declare that if he could assemble data on 800,000 stomachs, the " showing for indiscriminacy of predation would certainly be greatly increased."

What matters here is not the number of sheets but the form in which the facts are presented on them; and if the additional data were set out like those already under review, it is doubtful if they would be of much more assistance to the unprejudiced reader than those already offered. Paragraph 2 on p. 122 is an example. Here Dr. McAtee protests that insufficient credit is given to the powers of field observation of his assistants in the U.S. Biological Survey. But as it was a loose generalisation of his own that " birds habitually devour the excreta of their young " that called forth criticism, he can hardly object if his readers supposed that he, or those from whom he derived his information, were insufficiently acquainted with the nesting habits of birds. Similarly it was not " uncalled-for " to remark that analyses of stomach contents would be misleading unless samples were taken regularly from the same area throughout the year. It would certainly be an elementary precaution to take; but there is nothing in the presentation of the data to show that it was taken, and after all we can only judge of the facts as they are presented to us.

Paragraph 3. Here I must plead guilty to some loose writing myself. What I meant, and ought to have made clear, when discussing the food of the Song Thrush, was that this species is the only bird known *habitually* to take *Helix nemor-*

* W. L. McAtee, 1932, *Smithson. miscel. Coll.*, **85** (7) : 38.

alis and *H. aspersa*, as part of the regular food. The other birds mentioned take them only exceptionally, as Dr. Collinge's published analyses of stomach contents clearly show, though Dr. McAtee writes as though they fed as regularly on these snails as the Song Thrush does.

Paragraph 4. Dr. McAtee's further remarks on *Pogonomyrmex* seem beside the point. Granted that this genus is found only in a restricted area of the country—that did not prevent Dr. McAtee from citing the case triumphantly as further proof of the truth of his views. Whether it really is so, is not so certain. We learned from the original paper that there were 66 records of these ants from the stomachs of 25 species of birds. I adhere to what I said before, that the only inference that can be reasonably drawn from the figures supplied is that though various birds were ready to experiment with *Pogonomyrmex* as food, they were not very satisfied with the results of their experiment, when, as far as averages go (though really they have little or no meaning when worked out on these figures) we find that each species has only 2·6 records of the harvester ant to its credit. Now Dr. McAtee tells us that further analyses show 90 records from 29 species, and he adds "and so it goes with food habit studies." But how far is it going?

I cannot see how 90 records distributed over 29 species of birds support the theory of indiscriminate predation when 18 of the records—that is one-fifth—refer to a single species, namely Gambel's Quail. At first sight this high proportion suggests a parallel to the case of the Wheatear and *Bombus* to which I drew attention before. Is this Quail a species that has become adapted to eat with indifference or even relish insects that are repugnant to most birds? Let us suppose for a moment that this is the case, and set its records aside. Then we find that *Pogonomyrmex* was taken 72 times by 28 species, that is to say 2·5 records per species. Why does Dr. McAtee think that these figures help his case better than those given in his Smithsonian Paper? I repeat, it looks very much as if a number of bird species experimented with the harvester ant as food and rather disliked it, but that one species was so far adapted as to take it more freely. To support the theory of indiscriminate predation surely the records should be distributed more evenly over the 29 species to which they can be referred. But this is not all. Let us examine a little more closely the figures for Gambel's Quail itself, for they are instructive. We find that 84 stomachs were examined; but of these, only 18—that is, rather less than a quarter—contained the ant. Of these 18, one or some—characteristically we are not told exactly how many—were represented by a single ant, and the rest by numbers, again unspecified, up to 23.

All this simply means that neither Dr. McAtee nor anyone else, not merely from the data available, but from the data humanly procurable, can possibly determine whether this incidence of *Pogonomyrmex* in 84 individuals of Gambel's Quail is due to indiscriminate predation conditioned by the number and the availability of the prey; or by the taste of the predator, conditioned by its hunger, by its seasonal presence in the feeding area, and probably by other factors such as time relations in the killing of individuals for examination. The figures will fit either view, and express what they are desired to express.

"So it goes with food habit studies." And so it goes with the figures of Dr. McAtee. They really leave us very much where we were before.

Rejoinder (8 : 123) to Mr. Hugh B. Cott (7 : 94–96).

Mr. Cott communicated the following reply :—

In an earlier communication (1) I criticised the manner in which Dr. McAtee presented his data, namely in terms of the birds' stomachs containing different types of prey, rather than of the relative numbers of prey eaten—the figures which we essentially require in considering the efficiency of protective adaptations. Dr. McAtee counters my argument by pleading misrepresentation :—" This writer here as elsewhere shows a tendency to read his own meaning into my words and then criticise it." It is unfortunate that Dr. McAtee reserves a special meaning for words which he uses, and then takes exception when I point out that in speaking of the " number of captures " what he really means is the number of stomachs from which captures were taken.

Attention was also drawn above (1) to the fallacy of Dr. McAtee's central argument, which I now quote verbatim from his summary (2, p. 144). " The combined attack of birds plus all other predators still more closely approaches complete indiscriminacy. In other words there is a utilization of animals of practically every kind for food approximately in proportion to their numbers. This means that predation takes place much the same as if there were no such thing as protective adaptations. And this is only another way of saying that the phenomena classed by theorists as protective adaptations have little or no effectiveness." With these words Dr. McAtee dismisses the effectiveness of such adaptations as stings, spines, stinking or poisonous secretions, concealing coloration, warning colours and mimicry. This is like arguing that because during war certain infantry units suffer casualties approximately in proportion to their numerical strength, this means that casualties occur much the same as if there were no such thing as defence. And this is only another way of saying that the phenomena classed by theorists as bayonets, barbed-wire entanglements, poison gas, camouflage and strategy have little or no effectiveness.

Proportional predation by a group is a very different thing from indiscriminate predation by individual animals. Predation by one enemy on a " protected " species does not prove, as Dr. McAtee seems to imagine, that protective devices are ineffective against other enemies. It has been said that in America the automobile is the chief enemy of the toad. Now the automobile is " indiscriminate " in its attacks upon small animals; it is unaffected by the toads' poison; it accounts for thousands of victims annually, especially during the spawning migrations. But must we believe that because a large proportion of adult toads are killed by automobiles, the protective adaptations of these animals, *i.e.* their poisonous secretions, " have little or no effectiveness " against other potential enemies ?

What is the available evidence relating to the efficiency of the toads' secretions as a defence against enemies ? In Great Britain we have two species of toad (*Bufo bufo* and *B. calamita*) and one indigenous frog (*Rana temporaria*). If the number of species be taken as an indication of the numbers of individuals available (Dr. McAtee's standard (2, p. 7)), one might expect to find (according to Dr. McAtee's theory of proportional predation) approximately twice as many birds preying upon toads as upon frogs. Now the actual figures are interesting.

61 species of British birds prey upon frogs (RANIDAE); *
9 species of British birds prey upon toads (BUFONIDAE).

Anybody, except Dr. McAtee, would regard these figures as evidence that toads, as compared with frogs, are relatively unpalatable. Let us now consider Dr. McAtee's figures under this head (2, p. 121).

535 identifications of RANIDAE; Nearctic species, 22; †
60 identifications of BUFONIDAE; Nearctic species, 18.

His comments on these figures are illuminating :—" Clearly the RANIDAE or frogs are more preyed upon than any other group, certainly much more so than the toads. The theorist on adaptations attributes this to the superior special defenses of toads, but with no doubt whatever the difference in amount of predation on these two groups is a direct reflection of their relative abundance." In making this statement, Dr. McAtee conveniently ignores his own standard for estimating the relative abundance of individuals by reference to the number of species in the groups concerned. He gives us no reason for doing so, nor does he give any figures to support the present dogmatic assertion of proportional predation, which here, as usual, is cited as pointing to the inefficiency of protective adaptations in averting the attacks of foes.

Another fallacy of Dr. McAtee's is the assumption that a protected species should increase in numbers. He continues with reference to the toads as follows :—" If toads really were specially protected, if their so-called defenses saved them from a certain proportion of predatory attacks, should they not increase continually relative to the RANIDAE? The fact that they do not is the best proof that could be asked that their 'special defenses' do not actually function in nature." This is a remarkable statement from one who claims to speak with authority on protective adaptations, and yet makes the elementary mistake of inferring that predatory attack is the only effective check upon increase in numbers. It ignores the fact that animal numbers are controlled by many factors besides predation, among which may be mentioned parasites, climate, food supply, breeding sites, fecundity and longevity. Dr. McAtee here overlooks the fact that there are in every part of the habitable world animals with no predatory enemies whatever. The organisation of animal communities into complex systems of food chains ensures that certain dominant predators at the end of the chains have, normally, nothing to fear from predation. Examples of such terminal animals are the giant toad *Bufo marinus* in South America, and the Gannet and Golden Eagle in this country.

In replying to figures which I brought forward (1, p. 96) as evidence of discrimination in frogs, Dr. McAtee now states (3, p. 123) that he " never said or implied that predation by single species is in proportion to population." Yet his main argument against the effectiveness of protective adaptations depends upon the theory of proportional predation, which, he claims, " denotes indiscrimination, the very antithesis of selection " (2, p. 144).

Discrimination, or its opposite, can best be studied in reference to the food-

* Computed from Witherby, " A Practical Handbook of British Birds."
† Computed from Stejneger and Barbour, 1923, " Check list of North American Amphibians and Reptiles."

habits of individual species severally. When the food of single species is examined quantitatively, selection is found to occur not only in those higher groups, the birds and mammals, but in more lowly vertebrates such as the Anura. The following figures, which show the number of typically aposematic ("AA") food-animals included in the diet of certain East African and Canarian tree frogs examined by the writer, may be cited as evidence of discrimination and avoidance of unpalatable prey :—

Species.	Total prey.*	Aposematic Prey.	Per cent.
Hyperolius marmoratus . . .	2648	0	0·00
Hyperolius bayoni . . .	3641	1	0·03
Hyperolius argus	3249	4	0·12
Megalixalus fornasinii . . .	829	9	1·09
Megalixalus brachycnemis . .	31	0	0·00
Leptopelis johnstoni . . .	6	0	0·00
Phrynobatrachus acridoides . .	564	0	0·00
Hyla arborea var. *meridionalis* .	617	6	0·97

* Total number of prey classified in reference to colour. (6, Tables XII, XIII).

The following further evidence of differential food preference in the case of British Anura is based upon the identification of prey from the stomachs of *Bufo bufo* and *Rana temporaria* :—

4344 Hymenoptera recovered from *Bufo bufo* included only one bumble bee (*Bombus*) and three wasps (*Vespa*).

47 Hymenoptera recovered from *Rana temporaria* included a single bee and no wasps.

Last summer I carried out experiments to determine whether hive bees are acceptable or distasteful to toads, and to discover—if they proved distasteful—how quickly the toads learn to recognise and avoid these insects, and whether the lesson of avoidance, once learned, is remembered. An extract from a letter on this subject to Professor Poulton has been quoted elsewhere (4, p. 158). While it is hoped to publish shortly a full account of these experiments, it will not be inappropriate to add here a few facts bearing upon the question of protective adaptations of prey, and discrimination by predators.

The toads used were wild adults of *Bufo bufo*, which were kept for some weeks after capture in a roomy vivarium, where they fed well upon a variety of insects, notably mealworms, and cockroaches. Toads undergoing test were placed, one at a time, upon the landing board of an active beehive, and allowed the opportunity to feed, undisturbed, upon the outgoing and incoming bees : they were left alone to feed freely without interruption until each voluntarily terminated the experiment by jumping off the platform. When this happened, the toad was again placed in position and given a second opportunity to feed. The eighteen toads which formed the subjects for memory and discrimination tests were each placed on the hives twice daily for seven consecutive days, having been starved for a week before the first experiment. After visiting the hive on the seventh day, the toads were allowed to feed freely upon mealworms for twenty-four hours. They then rested for a fortnight, during which they were kept without any food. After this interval the experiments were repeated as before, each toad being taken

to the hives twice daily for seven consecutive days. After the fourteenth visit they were again allowed to feed freely on mealworms for twenty-four hours. The feed of mealworms offered after each set of experiments was useful as a check to show that the refusal of bees was not due to loss of appetite or to sickness. The results of these tests are summarised in the following tables which give (i) the number of toads accepting bees on each of the seven consecutive days preceding (Exp. I), and following (Exp. II), the fortnight's interval; and (ii) the total number of bees eaten by the same series of toads during the above experiments.

	(i) Number of toads eating (*a*) bees							(*b*) mealworms.
Days	1	2	3	4	5	6	7	7–8
Experiment I . .	14	10	7	4	2	3	0	16
Experiment II . .	5	4	4	3	3	1	0	16

	(ii) Number of (*a*) bees eaten							(*b*) mealworms eaten.
Days	1	2	3	4	5	6	7	7–8
Experiment I . .	24	33	14	8	5	3	0	219
Experiment II . .	12	9	4	6	3	2	0	213

It will be outside the scope of these remarks to say anything of the toads' behaviour during the experiments, beyond mentioning that this behaviour was such as to support the only reasonable interpretation of the above results, which clearly prove (1) that bees are unpalatable to toads; (2) that even under starvation conditions and in spite of great and progressive hunger, these animals learn to refuse the insects entirely, though afforded adequate opportunities to take them; (3) that the slowest toads, in a series of eighteen individuals, learned to avoid bees in seven days; (4) that the lesson is wholly, or partially remembered for at least a fortnight.

A further point of interest (not brought out in the above figures), is that out of thirty-three toads used for the whole series of experiments, no fewer than nine individuals learned to avoid the bees after a *single* trial. In eight of these cases, a single bee was eaten at the toad's first visit to the hive; each toad, on subsequent visits throughout the week, would have nothing more to do with the insects.

I would like to draw attention here to an aggressive review by Dr. McAtee (5), written in an uneconomical and, I should say, frivolous style, dealing with a recent publication of mine (6). As I propose to reply in detail elsewhere, I will do no more here than quote two sentences which bear directly upon the present discussion. Dr. McAtee says:—"The whole of the experimental evidence as to edibility of prey is scarcely worth the paper it is printed upon, a fact pointed out by McAtee twenty years ago. . . . The citing of any amount of experimental evidence as to choice of food leaves the student of the natural feeding habits of animals entirely unmoved" (5, p. 212).

Evidence should not leave a scientist unmoved. Dr. McAtee, with a prejudice that has no place in science, chooses to ignore any facts that do not fall in line

with his own doctrine. His argument is as conclusive as that used by Lord Peter in the great debate between himself and his brothers, recorded in "A Tale of a Tub," when they respectfully submitted that his brown loaf was not mutton. "Look ye, gentlemen," cries Peter in a rage, "to convince you what a couple of blind, positive, ignorant, wilful puppies you are, I will use but this plain argument; by G——, it is true, good, natural mutton as any in Leadenhall market; and G—— confound you both eternally, if you offer to believe otherwise."

References.

(1) 1932, *Proc. ent. Soc. Lond.*, **6** : 94–96.
(2) 1932, *Smithson. miscel. Coll.*, **85**, (7) : 1–201.
(3) 1933, *Proc. Roy. ent. Soc. Lond.*, **8** : 113–126.
(4) 1934, *Proc. Roy. ent. Soc. Lond.*, **8** : 158–159.
(5) 1933, *Quart. Rev. Biol.*, **8** : 209–213.
(6) 1932, *Proc. zool. Soc. Lond.*, **1932** : 471–541.

Rejoinder (8 : 124) to Miss E. A. Oehlenschlaeger (7 : 98–100).

Prof. Poulton replied on behalf of his friend Miss Oehlenschlaeger, whose communication had not been received in time for the meeting (see below).

Dr. McAtee's arrogant reply is characteristic. The conspicuous Lepidoptera refused by the young Purple Martins were among the commonest and their patterns among the most easily remembered of the Nearctic species. Miss Oehlenschlaeger is a keen and most observant naturalist, helped by the Assistant Curator of Entomology in the Milwaukee Museum, and to suggest that their identifications "appear to have no scientific validity" is simply an exhibition of the discourtesy we have learned to expect from Dr. McAtee. Moreover, from his own point of view, it is gratuitous discourtesy; for the names of these species are of no importance in relation to his criticisms of the theory of warning colours, although extremely interesting to the serious student of the theory. The fact that eight different conspicuous butterflies and moths were refused while other inconspicuous ones were accepted is a disproof of McAtee's confident assertions, whether we label the insects A, B, C, etc., or by their scientific names. It is also worthy of note that a writer who objects so strongly to the method of experimentation * here makes the criticism—"There was no experimentation"; and makes it incorrectly, for Miss Oehlenschlaeger states—"any moth or butterfly with brilliant colouring was refused as food. We tried this thoroughly without avail." As to the futile remarks about the experience of the young Martins, this was naturally gained on the first occasion when they were offered or found for themselves and thus tested the taste or smell of the conspicuous insects.

Miss Oehlenschlaeger's reply to Dr. McAtee, received after the meeting, is printed below :—

I have just finished re-reading, with closest attention, Dr. McAtee's criticisms of my observations on the refusal of the Purple Martin (*Progne subis*) to accept

* See the concluding paragraph of McAtee's paper (1912, *Proc. Acad. Nat. Sci. Philad.*, **64** : 364)—"Since this evidence [contents of stomachs, pellets, castings, etc.] is sufficient in itself, and since experimental data must be supported by it to be worthy of any consideration, why perform the experiments?"

brilliantly coloured insects as food. I regret very much that these records are of no value to Dr. McAtee, but the fact that they agreed with those of many other naturalists gives value to an experience upon which I came quite accidentally. I am not an entomologist, and know very little of insect mimicry, and the laws which govern it, or of warning coloration; but I hope I have intelligence sufficient to observe and record unusual behaviour in young birds which I had watched very closely for two months. The insects of bright coloration which were refused by my Martins are common species, abundant here during the summer. I have always known them, and my visits to the Milwaukee Museum were not made, as Dr. McAtee implies, for a late identification and the refreshing of an uncertain memory, but in order to obtain the recognised scientific names. I realised that this information was necessary in order to answer Prof. Poulton's questions. When the four young Martins arrived at my home their condition indicated the immediate need of food and moisture. I was unable at the time to gain any information about their natural food at this period of life, from any available ornithological literature or from my scientific friends. It thus became obvious that extreme care would be necessary in attempting to solve the problem by experiment—the only possible method.

The discussion held before the Entomological Society of London at its meeting on Dec. 7, 1932, gives a very clear and concise idea of Dr. McAtee's theory, elucidated by Dr. R. A. Fisher, F.R.S. The overwhelming mathematical, statistical and scientific data which it necessitates, are quite beyond my comprehension, but nothing that Dr. McAtee or any other ornithologist or entomologist may assert can throw doubt upon the observations made by my own eyes on the work of my own hands. Nor do I agree with Mr. Uvarov that the experiments were carried on under "unnatural conditions" (**7 :** 86). Any one having a love for young birds and the patience to observe their behaviour can eliminate the first two letters of the adjective. The birds were perfectly free, but also, perfectly confident. And, may I add, that *Progne subis* is by far the most intelligent of the birds known to me, although his memory is not as persistent as I might wish, for, on his return from the southward migration, the former confidence was forgotten no less than the association of a green dish with the favourite diet of mealworms!

The list of insects accepted and rejected by the Martins is printed on pp. 98–99 of the "Discussion" on Dec. 7, 1932. Possibly the very simplicity and limited duration of the enforced experiment renders it valueless for Dr. McAtee, but I can hardly be blamed for bringing to a close the series of observations which threatened the well-being of my birds. At the time, my interest in their previous behaviour ceased with the arrival of a box of mealworms from Chicago! But the desire to learn *why* the brilliant or strikingly coloured insects were rejected had become definitely fixed in my mind. I did not realise that my wish would find its fulfilment in the arrival of a copy of Prof. Poulton's address to the Zoological Section at the Centenary Meeting of the British Association in London, 1931. In this address—"A Hundred Years of Evolution" (pp. 89–92) I found the answer to my Insect–Martin riddle. It fitted absolutely with my observations, which, at the time, were both unbiased and untutored. Can it be maintained that the observed results were affected or rendered in any respect less valuable because the experiments were undertaken in the hope of providing food and without any intention

of carrying on a scientific investigation? And are four normally developed bird appetites, closely watched by an extremely interested group of intelligent people, worth less as evidence than the mutilated remains in a dead bird's stomach? Of "availability" there was a-plenty during those anxious days from August 26–Sept. 3, 1931, for the brightly coloured insects were offered to the birds in great numbers—with wings, without wings, the body entire or in part. But this, to me, horrid piece of work, was perfectly useless. Neither hunger nor "availability" aroused the desire in my Martins to eat conspicuously coloured butterflies.

Differences of opinion are natural in all scientific pursuits but I believe it has always been customary, in Natural Science, to accept in perfectly good faith, the statements of trustworthy laymen and women. If I, without any previous knowledge of the laws governing insect mimicry, have made observations leading to the same conclusions as those reached by Prof. Poulton and many others—conclusions which have been so abundantly confirmed, then I am most happy to have been able to add my very small part in still further support of their work and its interpretation.

Dr. McAtee's paper of 1912 concludes with the question—"*Why* perform the experiment?" Are not "Why?", "How?", and "What?" the dynamos that drive the Scientist's mind?

Evidence of the effectiveness in Nature of the Protective Adaptations in some insects (7 : 100–105).

Prof. Poulton replied to the concluding section of the rejoinder (**8** : 124–126) as follows :—

Dr. McAtee may rest assured that there has never been anything of "a thrill" in this controversy, conducted not with the slightest hope of convincing him, but in order to prevent others from being misled by his confident assertions shown on previous occasions and here again to be without foundation.

Referring to evidence quoted from the Biological Survey bulletins (*Proc.*, **7** : 100–104) Dr. McAtee replies that "all of the excerpts cited . . . are based on data which was [*sic*] incorporated in the grand assemblage upon which my Smithsonian paper was based. The whole is greater than any of its parts" (p. 124). Comparing then "the whole" with "the parts" and printing the latter in italics we find (full references in *Proc.*, **7** : 100–104) :—

Carabid beetles. "It is everywhere evident that the special defenses alleged . . . are more in the nature of pleasing fictions for theorists to speculate upon than practical reliances for the beetles concerned."—"*. . . either absent, or found but rarely in these birds' (thrushes, bluebird) food . . .*" Also, referring to the Hermit Thrush, "*. . . Carabidae are noticeable by their absence, as only a few remains appear.*"

Coccinellid beetles ". . . are freely eaten. No better example of the influence of availability in guiding choice of food by birds could be desired . . ." ". . . in California where Coccinellids are notably more abundant than they are in the eastern States, a larger number of birds feed upon them and they get a great many more of the beetles."—*Summarising Prof. F. E. L. Beal's record of the insect food of Californian birds we learn that, with the possible exception of the Pigmy*

Nuthatch, the only serious attacks on Coccinellidae are made by specialised enemies in the single genus Vireo, *and in this genus by all the species.*

The honey-bee—" Bees all sting [an incorrect statement], and the 797 records . . . would seem to indicate considerable disregard for the stings on the part of birds." " Thirty-two species of birds took honey bees . . . on a total of 118 occasions. . . . These numbers . . . seem in fair proportion to the availability of the bees concerned."—*In* 375 *stomachs of the Cliff or Eaves Swallow " the remains of* 35 *honey bees . . . were identified in* 13 *stomachs. . . . All were* [stingless] *males or drones. . . . Evidently the drones are deliberately selected by the eaves swallow. . . ." Honey bees were also represented by* 11 *drones in* 205 *stomachs of the Purple Martin, by* 1 *drone in* 467 *stomachs of the Barn Swallow, and were absent from the stomachs of two other Swallows.*

All the solid evidence summarised in the italicised sentences is dismissed by Dr. McAtee as " stray crumbs " of comfort for " selectionists," reminding us of the excuse made by a girl when blamed for having a baby—" It was such a little one ! "

With regard to McAtee's " *Conclusion* " (pp. 124–6), the simplest form of reply will be to make a brief statement of certain opinions held by Darwinians, thus correcting the supposed beliefs which exist in the author's imagination.

Darwinians hold not only that protective adaptations but also that numerical factors have an important bearing on predation and they entirely agree with the passage quoted from Swynnerton (p. 124 note).

To McAtee's question—" Is not cryptic coloration often hailed as a nearly perfect defense ? ", we reply—" No, and never correctly." On the contrary, Darwinians believe that this form of protection has been gradually evolved by the successful attacks of enemies and by the same means kept at a high level when attained. Cryptic species are far more numerous than aposematic and supply the bulk of the food eaten by insectivorous animals.

Referring to this belief McAtee continues—" The selectionist argument thus admits that many species are relatively unprotected and suffer more severely than protected forms from predatory attack." The species which McAtee describes as " relatively unprotected " are on the contrary extremely well protected by cryptic adaptations and suffer in greater numbers because they are themselves far more numerous and are hunted by a much greater number of enemies.

Since these cryptic species " maintain their numbers," McAtee concludes " we have proof that protective [warning] adaptations are not essential." This wonderful example of the *non sequitur* may be condensed as follows :—

Many species with cryptic adaptations maintain their numbers.

Fewer species with warning adaptations maintain their numbers.

Therefore warning adaptations are of no value in the struggle for existence !

McAtee continues—" On the other hand if all organisms have protective ' adaptations,' then the fact must be faced that predatory and other enemies must live, in fact do live and maintain their numbers, again demonstrating that the ' adaptations ' are not of decisive importance."

This confident assertion with its reiterated " must " is at once shown to be hollow by a glance at the record of animal extinction and evolution preserved in

the earth's crust. Again, considering the predators alone, can anyone maintain that their keen senses and swift correlated movements are not of decisive importance when we know that the struggle is severe enough to cause the extermination of all but a small fraction of each generation? Can it be doubted that the efficiency of this surviving fraction will be of a high standard and will tend to include those variations which would carry it to a still higher level? And the same argument applies with even greater force to the insect prey because, as compared with the Vertebrate predators, the surviving fraction is much smaller and the generations follow each other more rapidly.

Truly we may agree that there is something to be said for Dr. McAtee's conclusion that "the subject is one certainly best treated according to general principles."

Judging from an article in "Nature Magazine," Baltimore (Mar. 1934), to which my friend Dr. F. Morton Jones has directed my attention, Dr. McAtee deprecates the attempt to explain the adaptive meaning of structure but is willing to make an exception in favour of function. Thus in this article, "Tree-hoppers, Insects Worth Knowing," he writes on p. 119 :—"There has been much speculation about the utility of the bizarre structures of membracids, but that had better be left to the speculative. Need everything be placed on a basis of utility? Are the marvels of tree-hopper form any more in need of explanation than the comeliness of a flower, or the beauty of a sunset?" But on the next page he gives the following surprisingly different interpretation,—not to form this time, but to function :—"The nymphs share with adults a defensive habit of sidling around a plant stem so as to keep it between them and an intruder."

The majority of naturalists will hold that the beautifully detailed resemblance of *Umbonia* to a thorn is no less defensive than the movements described above, and they will altogether deny the conclusion that the qualities which give to a flower its comeliness, are useless to the plant itself.

Darwinians hold that the struggle for existence is extremely complex and that it is only carried to a successful issue by the help of *many* essential adaptations, among which Protective or Cryptic Resemblance is necessary for the existence of an immense number of species, and Special Protection with Warning Characters for a far smaller number. They hold that each of these adaptations depends for its efficiency upon the co-operation of various distinct subordinate adaptations and that all these have gradually reached and then maintained a high level of perfection by the elimination of the unfit and the consequent "survival of the fittest" through a long period of time during which there has been much adjustment and readjustment to changing conditions.

Comments on the Discussion on "Protective Adaptations of Animals, etc.," 7 Dec. 1932 (*Proc. ent. Soc. Lond.*, 7 : 79–105) in 1933, *Ibis*, (13) 3 : 800–1.

The following copy of these comments, sent by Mrs. M. D. Brindley, F.R.E.S., will, it is believed, be of interest to Fellows :—

"A most interesting discussion was initiated at the meeting of the Entomological Society on 7 December, 1932, on Dr. McAtee's paper entitled 'Effectiveness in

Nature, [etc].' We have not been favoured with a copy of this paper, but, judging from the discussion on it, Dr. McAtee appears to have based his opinions on the examination of some 80,000 stomach-contents, and come to the conclusion that phenomena classed as protective adaptations have little or no effectiveness against predators, that the efficiency of warning colours in the prey is questionable, and that availability is undoubtedly the chief factor involved in the choice of birds' food. Such statements naturally open up many and varied points of view, and the discussion, in which several prominent entomologists and others took part, elicited a good deal of damning evidence both against Dr. McAtee's conclusions and the statistical methods at [on] which he arrived at them.

"We cannot here do more than call the attention of ornithologists to this paper and the discussion on it, the perusal of which will well repay those who are interested in the subject. A wide field is open to those who have the time to study the exact food of various birds—their preferences, aversion or toleration, and the relation of these to nauseating properties, warning colours, mimicry, defensive weapons, etc., in the prey.

"We should have thought that, in England, at any rate, Dr. McAtee's conclusion that availability is the chief factor involved in the choice of food by birds, and that, therefore, selection plays no part, could be controverted by every-day observations in the countryside. We can call to mind caterpillars of the Small Tortoiseshell abundantly available which no birds except Cuckoos seemed to touch, and surely the earthworm must be among the most available of foods, yet the preference shown for it by the Song-Thrush, amongst the thrush tribe, is pronounced. The garden-snail is as available to the Blackbird as it is to the Song-Thrush, yet there is a marked preference for it only by the latter."

Communications.

The conspicuous *Papilio* (*Pharmacophagus*) *hector* L. refused by a Ceylon Lemur.

By Prof. Poulton.

The specimen referred to in the following letter written 4 March, 1934, by Mr. W. W. A. Phillips of Mousakande Group, Gammaduwa, Ceylon, was exhibited:—

"I have another Loris here, which I have had for some months in captivity, but I have been too busy of late, to carry out many feeding experiments. The enclosed *Papilio*, however, I gave to him one day, and it lived in the cage for three days. He refused to look at it, and I consider that it is a very good example of *warning colours*, showing their effectiveness. The butterfly is a common one in the low country and lower hills, and is generally seen fluttering close over the ground. I *have never* seen it attacked by any insect-eater."

The above recorded observation is an interesting addition to Mr. Phillips' notes * on the acceptances and refusals of insects by the Ceylon Lemur, *Loris tardigradus grandis*. In these earlier experiments the conspicuous *Papilio aristolochiae ceylonicus* Moore, allied to *hector*, was also refused by the Lemur (1932, **7**: 35, 50).

* 1931, *Proc. ent. Soc. Lond.*, **6**: 51; 1932, **7**: 32, 49.

Birds as Enemies of Dragonflies in Norway. By Prof. Poulton.

The Registrar has kindly told me of a brief but extremely interesting paper on this subject by Sven Sømme (1933, *Norsk Ent. Tidskr.*, **3** : 223–4). The observations recorded by the author are a most valuable addition to those published by Miss E. L. Turner and Mr. F. J. Killington in our 1932 (1933) *Proceedings*, **7** : 97. A rather full abstract of the paper is printed below.

In his opening paragraph the author refers to the numbers of Odonate wings he had found along the beaches of lakes or rivers—" sometimes in great abundance. Certainly this is a very common phenomenon. Actually one may very seldom examine shores of lakes during the time when dragonflies emerge without finding wings. As a rule, the wings belong to species of *Anisoptera*, but sometimes also to *Calopteryx*." He then refers to the statements of Wesenberg-Lund, Bird, and others that birds devour the insects " especially during the period of emergence "; also the conclusion of the first-named authority that Fringillidae (sparrows and others) are chiefly responsible for such attacks. In the author's opinion, however, these birds are not generally of great importance as enemies of dragonflies in Norway, and he states that he has " never seen sparrows taking dragonflies under natural conditions. In June 1931, however," he continues, " I hatched some specimens of *Somatochlora metallica*, at the Zoological Museum, Oslo, and one or two days after emergence I took them out and let them fly. They had hardly left my hand when they were seized by sparrows, which had their nests under the roofing of the building. The bodies were eaten, but the wings fell to the earth." At the same place and in the same month he bred some *Libellula quadrimaculata* L. and *Cordulia aenea* L., " and on the day after emergence . . . let them fly from the window. Before they had flown 50 meters, they were all seized by wagtails and eaten, their wings falling to the earth."

Among the birds which he observed seizing dragonflies under natural conditions the author mentions the chaffinch (*Fringilla coelebs* L.), although " this bird does not generally occur in numbers near water-edges." In Hof, Solør, 28 Jun., 1929, however, he saw many of them and especially wagtails in the neighbourhood of ditches " where dragonflies were emerging in great numbers. Lots of dragonfly wings, all belonging to the genus *Aeschna* (most of them females) were scattered about on the beaches."

The importance of the wagtail as an enemy of dragonflies was shown by the following observation :—At Mangen, on 20 Jun. 1930 he found *Leucorrhinia dubia* v.d.L., abundant but so lively that they were very difficult to capture although wagtails were seen catching and killing many specimens. On the following day, near Mangen, a wagtail was observed to seize a recently emerged *Onychogomphus forcipatus* L. By the banks of the river Hobøl in Østfold on 6 Jun. 1930 the exuviae of *Gomphus vulgatissimus* L., showed that great numbers, estimated at 10–20,000 per kilometre, had recently emerged, while the discarded wings proved that a high percentage had been immediately killed. No captures were seen but the wagtail was the only common bird along the river. Two days later at Unemselven, Svindal, Østfold fylke, very few wings were seen and " wagtails were scarse [sic], but the common sandpiper, *Actitis hypoleucos* L. was common."

On 24 Aug. 1930 a kestrel, probably *Cerchneis tinnunculus* L. was seen " hunt-

ing dragonflies over a small lake near Svindal, Østfold fylke. The bird was sitting in the top of a pine, now and then taking a flight over the tarn to seize a dragonfly." Twice he saw it catch *Aeshna grandis* L.

In conclusion the author emphasises the "very great and important loss of individuals . . . during and shortly after emergence." In his opinion "birds represent the greatest danger to the semiadult dragonflies," while "in Norway the most dangerous enemy . . . is the common wagtail. . . . To some extent this bird also feeds on adult Odonata." The kestrel "is probably most dangerous to adult ones, especially late in summer when some of the species (such as *Aeshna*) are frequently flying very high."

A print showing the Reed-warbler (*Acrocephalus scirpaceus* Herm.) carrying a dragonfly to its nestlings. By Prof. Poulton.

A copy of an excellent print kindly brought to his notice by the Registrar was exhibited on the screen. It had been reproduced from a photograph taken by Hermann Fischer and was published in "Spemanns Natur-Kalender—Juli 1934." A brief account of the natural history of the "Schilfsänger" is printed at the foot of the illustration. His friend Mr. F. J. Killington was confident that the dragonfly represented belonged to the Libellulidae and was, he believed, a species of *Sympetrum*, the depressed position of the wings being very characteristic of this genus. The abdomen, apparently somewhat dilated towards the apex, was probably that of a male.

The insect-food of two species of Chinese frogs in the vicinity of Kashing. By Prof. Poulton.

My friend the President has kindly shown me a recently published paper * of much interest, dealing with this subject. The main results are given in Table I (pp. 184–87)—an analysis of stomach contents undertaken in 1932 and based on the specimens extracted between 28 Apr. and 11 Oct., 1932, from 170 *Rana limnocharis* Wiegmann and 50 *R. nigromaculata* Hallowell, chiefly captured in rice-fields but also in other fields, meadows and orchards. The frogs were killed at once "to prevent further digestion and were then preserved in 4% formalin before dissection." All the prey were adult unless otherwise stated.

In the abstract printed below, the first of the two numbers following each group gives the number of specimens extracted from 170 *limnocharis*, the second from 50 *nigromaculata*. The totals of the Insect Orders and the Invertebrata other than Insecta are quoted from Table III (pp. 188–89).

Among the Invertebrata outside the Insecta (totals: 118 + 31) there were found—Spiders: 32 + 12; Scorpions: 15 + 2; Ticks: 1 + 0.

Hymenoptera (totals: 181 + 18) included Braconidae: 3 + 0; Chalcididae: 15 + 0; Mutillidae: 1 + 0; Formicidae: 156 + 16; unclassified Hymenoptera: 6 + 0. The absence of Vespoidea, Sphecoidea and Apoidea is significant.

* Liu (Chi-Ying) and Chen (Kan-Fan). "Analysis of the Stomach Contents of two Species of Frogs (*Rana limnocharis* and *Rana nigromaculata*) in the Vicinity of Kashing with special Reference to Insects."—*Yearb. Bur. Ent. Hangchow*, **2**: 183–191. Hangchow (1932), August 1933. (With a Summary in Chinese.)

Among the numerous Coleoptera of many groups (totals: 102 + 25) the Coccinellidae are only represented by *Propylaea japonica* Thunb.: 7 + 1, its presence being "certainly due to the infestations of aphid colonies on rice plant and winter vetch, a common green-manure crop in this region" (p. 191). The Chrysomelidae are also few: 8 + 1. Other Phytophaga were *Monolepta nigrobilineata* Mots. (Galerucinae): 11 + 2; *Abirus fortunei* Baly (Chrysomelinae): 0 + 1; *Phyllotreta vittata* F. (Halticinae): 2 + 0, the last-named yellow-striped flea-beetle perhaps owing its origin to vegetable gardens or vegetables planted in orchards (p. 191).

Lepidoptera, all as larvae, included only the following:—Pyralidae: 0 + 1, also *Chilo simplex* (Crambites): 2 + 0 (supposed to be eaten during migration); Geometridae: 2 + 0; Noctuidae: 6 + 2; Hesperiidae (*Parnara guttata* Brem.): 1 + 1; unclassified Lepidoptera: 22 + 0. The relatively small totals: 33 + 4, are remarkable.

The totals of the Hemiptera and Homoptera, both of many groups, were 15 + 2 (plus 5 eggs) and 90 + 15, respectively, the latter including 60 + 7 Aphididae.

Orthoptera in many groups totalled 29 + 5, the Blattidae being only 0 + 1.

The totals of other prey for comparison with the above were:—Ephemeridae: 1 + 0; Odonata: 1 + 0; Trichoptera: 2 + 0; Diptera: 92 + 19; unclassified Insecta: 3 + 0. Under the Hymenoptera, however, this last record stands as 3 + 2.

The authors conclude that the "stomach contents . . . shown in Table I represent a more or less typical sample of the terrestrial and aquatic insect components of a rice field in this region" (pp. 190–91), and that "numerical abundance seems to be a very important factor" (p. 189)—an importance recognised by every naturalist, although not so far as to neglect the significance of other factors. Thus we cannot believe that bees, wasps and Fossors are absent from the rice-fields while the single Mutillid may have been a stingless male. It is most improbable that the Coccinellidae are represented by only a single species of ladybird and the Phytophaga by no more than the species named, or that the 17 Hemiptera and the single Blattid represent the proportionate abundance of their groups.

Striking concerted aposematic defence by a gregarious Burmese caterpillar. By Prof. Poulton.

My friend Mr. A. H. Hamm has noticed and kindly copied for me the following interesting passage in Capt. F. Kingdon Ward's book.* The date was about 7 July, 1914, inasmuch as the previous chapter closed with 30 June.

"Little more than a week later we set out a second time for Imaw Bum, but alas! by this time the weather had suffered a relapse.

"As before, we made straight for the Ngawchang Nka over hill and dale, sleeping just above the river.

"Pushing through the thick growth in the stream bed hard by the Yawyin village where we had slept previously, my attention was attracted to the strange circumstance of some tall stinging nettles rocking to and fro in still air, and turning

* "In Farthest Burma," Lond., 1921, chap. v, p. 81.

to them I found that this motion was caused by a number of large caterpillars agitating the leaves. These formidable larvae, apprehensive at my approach, had raised their heads, snake-like, and darting them rapidly to and fro caused the leaves on which they sat to shiver and tremble in the manner described. The trembling motion became still more marked as I looked closer, and when finally I touched one, several of them ejected at me, with considerable violence, drops of dark green fluid. Such mummery is evidently designed to scare away some enemy, but whether bird, spider or insect I did not ascertain."

It is probable, as Mr. Hamm suggests, that the larvae were those of a Nymphaline butterfly, exhibiting in a far more extreme form the protective adaptations of some of our British nettle-feeding VANESSIDAE which also eject a green fluid—especially plentiful in *Nymphalis io* L.—and exhibit concerted movements, on disturbance. The conspicuous movement described by the author as imparted to the food-plant is particularly interesting.

[Since these words were written I have communicated with the author who kindly wrote, 20 May, 1934 :—" I have now looked up the reference in my diary. No size is given but the context has brought back a memory of the larva which I recollect as about 2 inches long, dark and spiny, like a ' Peacock Butterfly ' caterpillar."—E. B. P.]

English names of British Moths recorded by William Jones of Chelsea :—a correction. By Prof. POULTON.

Mr. H. M. Edelsten and Mr. W. H. T. Tams, while preparing a complete list of these English names with their scientific equivalents, have detected two mistakes in the determinations published in 1933, *Proc. ent. Soc. Lond.*, **8** : 103.

The " Pretty Widow " determined as *Schistostege decussata* Schiff should have been *Eupithecia venosata* F. The error arose because *decussata* is a synonym of the latter species, which is evidently intended.

Similarly the " Green Huswife " should have been *Hemithea aestivaria* Hb. and not *Thalera fimbrialis*, *thymiaria* being a synonym of both these.

Furthermore, the comparison between William Jones' English names and those given by Haworth in the " Lepidoptera Britannica " has shown that the " Chimney Sweeper's Boy," supposed to be the same species as the " Chimney Sweeper," *Odezia atrata* L. (*loc. cit.*), was the name given to the Psychid moth *Fumaria plumistrea* Hübn., placed as a synonym of *Epichnopteryx pulla* Esp. by Staudinger, a conclusion accepted by Meyrick in his " Revised Handbook of the British Lepidoptera," Lond., 1927 (Preface). The four other species of *Fumaria* recognised by Haworth (" Lep. Brit." : 373, 374) are all named as various forms of " Chimney-Sweeper "—the " transparent," " light," " shining," and " lesser "—while the Geometrid *Phalaena chaerophyllata* F. (*O. atrata*) is appropriately distinguished as the " looping Chimney Sweeper." The above information has been kindly supplied by my friends Mr. E. Meyrick, F.R.S., and Mr. Tams, the latter having written :—" The genus *Fumaria* Haworth belongs to the PSYCHIDAE, and has for type, according to Durrant, *F. casta*. Haworth's citation of Hübner's figure Tinea, no. 213 (*plumistrella*) is incorrect, and the insect he refers to is *Epichnopteryx pulla* Esper (cf. Meyr., Kirby and Staudinger). See also Dalla Torre and Strand, *Lepidopterorum Catalogus*, **34**,—PSYCHIDAE, and Tutt, ' British

Lepidoptera,' 2. Hübner's *T. plumistrella* is now known as *Lepidoscioptera plumistrella*."

The dispersal of freshly emerged insects as an adaptation to prevent in-breeding. By Prof. Poulton.

I have received a letter from my friend, our Hon. Fellow Dr. L. O. Howard, referring to p. 169 of the Annual Address, 17 Jan. 1934 :—

20 *Mar.* 1934.—" We have known for 20 years or more, in our work in importing, rearing and liberating parasitic insects, that we cannot expect success in establishing new forms unless we liberate them *in large colonies*—several hundreds or a thousand—since their first impulse is to *disperse* far beyond the possibility of mating. So you see the exact parallel with your observation. I am sure that I have mentioned the fact many times in print, and surely it occurs in Bulletin 91 of this Bureau by W. F. Fiske and myself."

My friend Dr. S. A. Neave, our President, has very kindly sent me a copy of the following quotation—referred to by Dr. Howard—from the 1911, *U.S. Dept. Agric. Bur. Ent. Bull.*, **91** : 14, entitled " The Importation into the United States of the Parasites of the Gipsy Moth and the Brown-tail Moth : A Report of Progress, with some consideration of previous and concurrent efforts of this kind," by L. O. Howard and W. F. Fiske :—

" It was first thought that when parasites had been reared in sufficient numbers they should be widely distributed in small colonies, on the theory that each colony would remain in substantially the same general locality and would increase and spread from that point. This idea was a natural one and was fully justified by previous work which had been done with parasites of other groups of insects, but in this case it proved to be erroneous, and valuable time and valuable specimens were lost. Eventually it was shown to be of prime importance, first to establish a given species of parasite in this country, and not until this has been accomplished to pay any attention to the matter of dispersion. It seems to be the first instinct of many species that have been imported to spread widely. Therefore, if the colony put out be a small one the individuals composing it spread rapidly beyond all means of meeting and of mating, and thus the colonies in many instances were lost. By rearing in the laboratory, however, until colonies of at least a thousand are to be had, such colonies while dispersing are much more likely to remain in touch, mate, and multiply."

Dr. Neave adds :—" So far as we have been able to find them, other remarks by Dr. Howard on the same subject appear to refer back to this Bulletin."

The food-preferences of the starling. By Prof. Poulton.

I have also received a letter kindly written 14 Apr. 1934 by Dr. H. N. Kluijver, referring to pages 160–1 and 170–2 of the last Annual Address :—

" I very well agree with the conclusions you drew from my observations. I also drew attention to the fact that slugs and Curculionids occurred in the food in much smaller quantities than could be expected. I supposed that the starlings have a preference for other animals.

" It may perhaps interest you to know that the two *Euchelia jacobaeae* L., [pp. 161, 170] were captured when leaving their pupae."

Dr. L. O. Howard had also written in the letter quoted on p. 45 :—" The European Starling, which is becoming much of a nuisance with us, is said to feed avidly on the Japanese beetle (*Popillia japonica* Newm.)."

A note on the Ortalid fly *Callopistromyia annulipes* Macquart. By J. M. Aldrich.*

" 6*th April*, 1934.

" I am sending you now a box containing three specimens of an ortalid fly—*Callopistromyia annulipes* Macquart. One of these I collected on the wooden railing of a bridge in a park in this city [Washington]. It was all by itself and was holding its wings vertically and apparently strutting, walking at a slow pace. After capturing it I took some trouble to mount it with the wings in the strutting position; and I was rather surprised to see that it is a female. I have seen one other specimen of the same species going through a similar performance and it was also a female. I did not mount it with the wings erect in this case.

" The speckled appearance of the fly, together with the fact that it is ordinarily found on trunks of trees or old logs where it matches its surroundings extremely well, would seem to indicate protective coloration, but the habit is quite different."

An apparent gynandromorph of *Kallima inachus* Bdv. By Prof. Hale Carpenter.

The specimen exhibited bearing data " Khasi H(ills) 1910 " was discovered by Commander J. J. Walker, R.N. It is noteworthy for the much greater size of the right wings. On closer inspection the suggestion that the larger wings are of the female type is borne out by the fuller outline of the hind-wing along the outer margin anterior to the tail. There is no great difference between the appearance of the two sides above, save for the point to be mentioned later, but beneath there is a striking difference.

The smaller, left, wings are of the wet-season form, with the costal and anal angles not greatly prolonged and showing considerable mottling with dark and light brown, and speckling which resembles the fungus growth on a wet dead leaf as Prof. Poulton has pointed out.

The larger, right, female, wings are of the dry-season form, showing the typically elongated pointed or hooked tip to the fore-wing and longer tail, and a lighter, more uniform brown ground-colour with less conspicuous mottlings and apparent fungus marks.

While the wings appear to be of two sexes both front legs show the characteristic appearance of the male Nymphaline.

There is no evidence that the specimen is an artifact, and Mr. N. D. Riley and Dr. H. Eltringham, F.R.S., who kindly examined the specimen, agreed that it appears to be a natural product.

The specimen was among a number of the duplicates in the collection given to the Hope Department, Oxford University Museum, by the widow of the late Col. Turenne-Jermyn, and appears to have been unobserved. This fact also is of importance as showing that it was not obtained as a specimen of great interest, and therefore is not likely to be a deliberate artifact.

* Communicated by Prof. Hale Carpenter.

Attacks of birds and other enemies on butterflies. By Prof. Hale Carpenter.

There are many difficulties in the interpretation of marks on the wings of Lepidoptera, and a specimen was exhibited to illustrate this.

Commander Walker, R.N., has presented to the Oxford University Museum a *Salamis antevа* Ward, from Madagascar, bearing on the upper surface of the right fore-wing an elongated triangular mark, very sharply defined, which might be held to be the imprint of the beak of a kingfisher such as was illustrated in the *Proceedings* for 6 Dec. 1933. The mark extends from the outer margin, its limbs corresponding roughly with veins 3 and 4, to the inner edge of the costal vein: the costal vein itself is not damaged. Were this mark at all represented on the under surface it might justly be considered the work of a kingfisher.

If the butterfly had been seized while the wing was outspread flat on a leaf it is possible that the leaf might also have been gripped and would have prevented the lower mandible from marking the wing.

The mark is so straight and regular that it is very difficult to account for it as a scratch from a thorn or anything else, unless it had been accidentally inflicted after death by mishandling. If it was the result of forcible folding of the wing in the net, as sometimes happens, it is difficult to understand how the apex of the fold at the costal margin, did not break the costal vein.

A further point of interest is the fact that each hind-wing has a piece excised from the hind margin, the gap being at the end of vein 2 on the left wing and vein 3 on the hind-wing, but they could have been due to a bite by a bird on both wings when closed not quite in perfect alignment.

The following Palaearctic Lepidoptera were exhibited showing evidence of attacks by birds as described in each case. They were collected by Fleet-Paymaster T. Bainbrigge Fletcher, R.N., who had kindly presented them to the University collection at Oxford.

1. *Polyommatus icarus* Rott, a male in fresh condition from Hautes Alpes, Lauteret, 6 Aug. 1932. The outer half of the left hind-wing and a large part of the right hind-wing internal to vein 2 are torn away. The left fore-wing bears a narrow triangular imprint directed forwards and inwards from the middle of the inner margin towards the costa. The base of the mark corresponds with the outer torn edge of the hind-wing: it is visible on the under surface.

2. *Agriades bellargus* Rott, a male, Stroud, 8 Aug. 1933, in very fresh condition. Each fore-wing bears a triangular mark, broader than in the last case, extending from the inner margin, just internal to the anal angle, forwards and slightly inwards to the costa. The mark is less distinct on the underside, but can be traced. On the right wing the limb of the mark nearest the body is distinctly more rubbed. Each hind-wing bears a single scratch running backwards and inwards from a point opposite to the end of the inner limb of the mark on the front wing. It would appear that this is due to the tip of the bird's beak having passed between the closed hind-wings to seize both fore-wings, when the butterfly was at rest.

3. *Agriades corydon* Poda, a male, Martigny, 8 Sept. 1925. Both hind-wings have had the outer margin cleanly sheared off from the anal angle to the costal angle, leaving an almost straight edge. In addition the right fore-wing bears a triangular mark extending forward from the anal angle to the costa, the better-

marked inner limb being just internal to the angle, and the outer limb on the hind margin at vein 2. The mark is clearly visible on the under surface, and presumably represents a further snap at the butterfly after the margins of the hind-wings had been shorn off.

4. *Agriades corydon* Poda, a male, Valais, Berisal, 5000 ft., 1 Sept. 1926. A V-shaped piece has been cleanly cut out of the right hind-wing, leaving a gap between veins 2 and 6, extending to the base of the cell: on the left side the greater part of the wing has been cut away anterior to vein 2. Evidently the two hind-wings were seized in the position of complete rest.

5. The Geometrid moth *Tanagra chaerophyllata* Linn., Valais, Berisal, 5000 ft., 7 Aug. 1926. The two right wings appear to have been seized when the fore-wing lay on top of the other: each bears an extremely clear imprint directed *backwards* from the anterior margin to the anal angle, and best described as a truncated cone with base on the costal margin. The imprint is that of a large beak whose apex extended beyond the hind margin of the wings, for it is not shown on the wing. The interest of this mark is that it shows that the attack was from in front, whereas in all the LYCAENIDAE previously mentioned, bearing spots along or near the hind margin, the attack was from behind.

6. *Zygaena exulans* Hochw., Hautes Alpes, Lauteret, 5 Aug. 1932. Found lying on a rock minus head and abdomen but with the wings indicating that it was a fresh specimen. Whatever enemy had attacked it had not cared to finish it. Bainbrigge Fletcher stated that there was a fresh bird-dropping on the rock, and the headless moth was still alive. This exemplified the toughness or strong hold on life which was characteristic of aposematic species such as *Zygaena* and would sometimes enable them to emerge little harmed from an encounter with a not-too-hungry enemy.

The following Indian butterflies were also exhibited which had been collected by Lt.-Col. F. C. Fraser, I.M.S., who had kindly presented them to the Oxford University Museum.

1. *Kallima horsfieldi* Koll., male, Kotagiri Ghat, Nilgiris, 23 July, 1933. Both hind-wings had a large piece shorn away from the anal angle to the level of vein 4 on the hind margin: the appearance suggests that it was done by a lizard.

2. *Discophora tullia* Moore, Coorg, Mangalore Ghat, 23 May, 1923. Both hind-wings had a gap between vein 1*b* and 3 extending for about half an inch into the wing. The breadth of the inner end of this gap suggested the mouth of a lizard rather than a bird.

3. *Eriboea athamas* Dru. from Coimbatore District. A broad piece has been torn or cut from each hind-wing extending forwards as far as vein 3 and along the anal margin to the level of the tip of the abdomen. This also suggests a lizard.

Col. Fraser in a MSS. note attached to specimens 1 and 2 stated that these highly procryptic species had "yet been open to attack." But surely it is expecting too much of any protective device to assume that it will secure immunity to all its bearers always? Moreover, it is only by such attacks that selection can work: a bird or lizard which caused *no* loss to a species could not, *ipso facto*, act as a selective agent. Thirdly, in spite of attack these butterflies had escaped with their lives, since they were captured by Col. Fraser. The brittleness of the wings and their large expanse had resulted in an injury of no consequence.

A new and very distinct subspecies of the coast-frequenting Tortrix *Polychrosis littoralis* Westw. (Curt.). By H. J. Turner.

The specimens exhibited were taken by Dr. H. D. Smart, F.R.E.S., on Annet island in the Scillies. After examination and comparison with specimens in the British Museum a male was examined by Mr. F. N. Pierce who reported that the genitalia were identical with that of typical *littoralis*. The new subspecies is so distinct, however, that I have named it *P. littoralis* subsp. *annetensis* in the 1934, *Ent. Rec.* **46** : 52.

A living spider imported into England. By Prof. W. A. F. Balfour-Browne, F.R.S.E.

The spider exhibited was found in a consignment of bananas imported into this country. It had not yet been possible to identify the species, but this would be attempted later.

Wednesday, 6th June, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Exhibits.

The following communications were made to the meeting :—

The habits and parasites of *Selenis suero* Cram. (Lep., Noctuidae). By J. G. Myers, Sc.D.

(Communicated by the Secretary.)

In October, 1932, in the small and isolated Kurasabai Savannah, in the foothills of the Pakaraima mountains of British Guiana, I found a very curious boring caterpillar, which proved to be the larva of the Noctuid moth, *Selenis suero* Cram., boring only for the purpose of pupation.

The host-plant, *Aeschynomene laxa* Gleason, related to the Indian shrub which supplies the material for solah topees, is a tall straggling suffruticose bush, with small purplish Papilionaceous flowers, finely pinnate mimosa-like leaves, and swollen pithy bases to the stems. There are numerous sticky glands on the thin, spindling leaf-bearing twigs, which branch off abruptly from the much stouter stem. At Kurasabai it grew plentifully in the open savannah, on the drying margins (widely inundated in the wet season) of a small pond, among grasses, sedges and coarse herbs, including *Sagittaria* sp., *Paspalum densum*, *Sacciolepis* sp., and *Scleria* sp.

The nearly full-fed caterpillars were found on the foliage, which they had very largely destroyed. The larva is of extraordinary appearance, with scattered long black hairs, and two long, fleshy, backwardly directed caudal processes. All the prepupae and pupae were found in borings in the main stem of the plant. This curious habit may probably be ascribed to the fact that the soil at the base of the plant lies under water for at least half the year. The upper inter-nodes of the main stem are hollow, though the central lumen is not wide enough to admit

the caterpillar, which is of considerable size. The original cavity is eaten into by the caterpillar and then smoothly enlarged, so that the prepupa, head upwards, fits in like a plug. The reduced anal processes are directed forward like the fork of a Collembollan, along the underside, and the long hairs, also somewhat shortened, are similarly flattened forwards. The pupa, always head upwards, lies just below the opening into the stem, which is completely covered with a transparent window, apparently of silk. In one or two cases the widening of the original cavity had weakened the stem so that it snapped and bent over, more or less exposing the pupa. The stems were nearly always already bored from top to bottom, and showed some reddish frass, but the central cavity was very little enlarged by this borer, an elongate weevil grub which was found at work actually in the swollen base only. Some of the *Selenis* pupae were in stems which had not been previously bored; so the pupation chambers certainly stand as the independent work of the full-fed caterpillar.

A striking feature was the heavy incidence of parasitism by a number of different insects. One pupa, broken at the top, contained three roundish elliptical Tachinid puparia, of which two had already yielded flies, while the other contained a stout *Alysia*-like Braconid (?) larva, completely filling it. This hyperparasite larva was unfortunately not reared. Numerous other parasitised *Selenis* pupae were found, and reared to a new species of Tachinid, *Prophryno myersi* Aldrich. Other pupae were parasitised by a species of *Spilochalcis*. One of the Prophryne puparia yielded a second hyperparasite, a small black *Chalcis* sp.

Every caterpillar found outside the stems, and still on the foliage, was parasitised by a *Euplectrus*, the naked larvae of which fed, in the usual manner, in a close group on the dorsum of the host. Most of the latter were, however, already dead and plastered to the twigs by a layer of loose, shining silken *Euplectrus* cocoons, evenly disposed beneath their dried skins. The infestation of *Aeschynomene* by *Selenis* was evidently in its concluding stages. With the further advance of the dry season, the pupae would remain in the dead dried stems, and emerge in the rains to attack the new young growth shooting from the then wet mud. The concentration of parasites in the final stages of an infestation is well known and easily explicable.

The parasites of *Selenis* may be summed up as follows :—

Primary on the larva—*Euplectrus* sp.

Primary on the pupa—*Prophryno myersi*, *Spilochalcis* sp.

Secondary, attacking the *Prophryne* puparia.—*Chalcis* sp., Undetermined Braconid.

I am indebted to the U.S. National Herbarium for determining the plant and to the Imperial Institute of Entomology (and Dr. J. M. Aldrich) for the naming of the moth and the Tachinid.

Some rare insects from Windsor Forest. By H. St. J. K. Donisthorpe.

On 8th May I took a specimen of *Diprion polytomum* Htg., when beating spruce in Windsor Forest. Only 2 other British specimens are known to me, both from the New Forest, and of these, 1 is in the British Museum.

On 5th May at the same locality I took *Aleochara discipennis* Muls. on cow-

dung. This species has only been recorded from the Isle of Sheppey (Comm. *J. J. Walker*) and the New Forest (Dr. *D. Sharp*) on sheep, and horse-dung, respectively.

On 30th May, 1929, and 31st May, 1934, I took a specimen of *Megapenthes lugens* whilst beating hawthorn in Windsor Forest.

A probable first record for Britain of *Brithys crini*. By J. A. C. Greenwood.

I have some specimens of a moth which as far as can be ascertained from existing records has not previously been taken in the British Isles. In October 1933 I found twenty-four larvae within a few yards of one another in a flower bed at Kew Gardens. They were fairly large and very conspicuous and were feeding on a low-growing plant, *Zephyranthes candida*, a white flower rather like a crocus and commonly used for edging at Kew. This plant has been growing in the bed for many years, having, I understand, originally come from the Argentine. I was quite unable to identify the larvae in spite of their unusual appearance and finally sent one to Mr. Riley of the British Museum. He stated that Mr. Tams and he were of the opinion that they were *Brithys pancratii* or *B. crini*. From the preserved specimens in the museum collections and the descriptions available certain identification was not possible. A further search did not reveal any more larvae, but on inquiry at the gardens I was told that they had previously been noticed by an under-gardener and sprayed with insecticide, apparently without the least effect. Two larvae were subsequently found by one of the staff but were not reared.

By the kindness of Sir Arthur Hill, the director, I was able to obtain supplies of *Zephyranthes* at frequent intervals from Kew, and Mr. C. N. Hawkins, who assisted me in endeavouring to rear some of the larvae, and I, tried them with various alternative plants, but we did not succeed in inducing them to more than nibble a daffodil bulb. In its native country *B. crini* feeds on *Pancratium maritimum* and plants of the orders Amaryllidaceae and Liliaceae.

Twenty of the larvae pupated, and as Mr. Hawkins and I were doubtful of the conditions required to rear them successfully it was decided to keep half the pupae at Kew, where they were housed in a glasshouse at a constant temperature of 60° F. with a moist atmosphere. These conditions were apparently suitable as nine moths emerged from the ten pupae on 27th and 28th March, 1934. I obtained a number of eggs from two females, but these were not fertile. Although several are still alive the pupae kept by Mr. Hawkins and myself at normal temperatures show no signs of emerging.

Having obtained imagines I submitted these to Mr. Tams for identification and he, having kindly examined the genitalia, is fairly certain that *B. pancratii* and *B. crini* are the same species, since he has so far been quite unable to discover any difference between those found at Kew and five specimens of *B. pancratii* and *B. crini* from different localities. *B. crini* was described about 150 years ago and *B. pancratii* a few years later.

It is difficult to suggest how the moth was introduced into this country. The authorities at Kew say that no plants from the localities where it is found have been recently introduced near the place in the gardens where the larvae were found, but the fact that all the specimens were so near together seems to indicate

the presence of a female. *B. pancratii* and *B. crini* have a wide range from the Mediterranean region to India and Java, but as it is not possible to localise this it becomes even more difficult to guess at the possible method of introduction.

(Since the above was written a male emerged on 10th June, 1934 (C. N. Hawkins), and a male and female on 13th June (J. A. C. G.).)

A ♂ *Leptidea sinapis* L., *in cop.* with a dead ♀. By Col. F. A. Labouchere.

When collecting in Sussex recently I saw what I took to be a pair of *L. sinapis* paired on a flower head. On further investigation, however, I discovered that the male was clasping the dead body of a female to which the right hind-wing was still attached.

I presume the female to have been attacked by a bird and the male to have flown off still clasping the remains of his mate.

African HESPERIIDAE and attacks by birds. By Professor Hale Carpenter.

The following specimens were exhibited from the Hope Collections, Oxford University Museum.

1. *Parnara detecta* Tr., captured 30 Oct., 1925, in S.W. Abyssinia by Mr. (now Sir) Arnold Hodson, at about 1900 feet elevation. The wings are somewhat rubbed, and on the right fore-wing are two V-marks directed backwards and outwards from the costa, one at about the centre of the costa being longer than the other nearer to the apex. The marks were at first considered to be such as might have been made by the beak of a bird, but when more closely scrutinised with a lens it was found that a doubt was suggested by the fact that the inner limb of the inner mark began on the edge of the sub-costal nerve, which was broken at that point. Anterior to this the costal margin of the wing was broadly rubbed, and it is possible that the nerve had been broken by a fold of the wing. This, however, does not account for the outer V-mark, but this being invisible on the under surface cannot be fairly claimed as a beak mark.

2. *Celaenorrhinus galenus* F. captured 16 April, 1925, by the same captor at Maji, S.W. Abyssinia. The hind-wing on each side has a small Λ-shaped notch, just internal to vein 2 on the left side, external to vein 2 on the right side. On the left wings, directed forwards, is an elongated triangular mark the apex of which is on the hind margin of the front wing, but the greater part on the hind-wing. Although the base of the triangle is not visible behind the middle of the hind-wing, its inner limb, if continued backwards, leads to the notch on the margin of the hind-wing. The Λ-mark is visible on the under surface of the hind-wing.

3. *Sarangesa eliminata* Holl., from Port Sudan, captured 3 March, 1912, by the late Dr. G. B. Longstaff. The right front wing bears an elongated rather narrow triangular mark extending forwards from the posterior margin and slightly outwards. The tip of the mark is slightly on the inner side, and between it and the main part of the mark is a length of about one millimetre on which no mark is visible. The wing has obviously been folded or crumpled when the beak was pushed across it from behind so that on expanding again it showed the mark in two parts. The mark is visible beneath. The right hind-wing bears a curiously shaped mark radiating in two directions from the centre of the wing, and equally

well shown on the under surface, which suggests that it also has been crumpled, but the mark cannot be considered as showing the accurate imprint of a beak so much as the result of pressure of a beak upon a wing folded on itself. The posterior end of one of the radiating marks leads to a notch in the hind-wing between veins two and three. The narrowness of the imprint on the anterior wing suggests the beak of a Bee-eater.

Incipient mimicry by a Californian form of the Nymphaline butterfly *Basilarchia weidemeyerii* Edw., of the *B. lorquini* Boisd., and *Adelpha californica* Butl., association. By Prof. E. B. Poulton.

The three male examples of *weidemeyerii nevadae*, exhibited to the meeting, were very kindly sent to me by my friend Commander C. M. Dammers of Riverside, California, who has helped me for many years in the further study of the fascinating western N. American diaposematic association between *A. californica* and *B. lorquini* of which a preliminary account was given in 1908, *Trans. ent. Soc. Lond.*, **1908** : 447, pl. xxv. The three specimens were taken 25 July, 1933, in the Mono Basin, Central California, by Dr. John A. Comstock. Two of them exhibit, over an area at the apex of the fore-wing upper surface and slightly larger in one specimen, an orange tint resembling but distinctly paler than that of the corresponding but much larger area in *B. lorquini*. The white upper-surface markings of these two specimens, but not of the third, also show a very slight approach towards the cream-colour of these markings in *lorquini* (see p. 56).

I was very anxious to learn whether this western form of *weidemeyerii* is a new species or a sub-species, as was rendered probable by the different degree of development of the orange area in two specimens and the fact that the third was indistinguishable from typical examples of the parent form in the Rocky Mountain region from Montana to Colorado. I therefore asked my kind friend Dr. Eltringham if he would make preparations of the male armature of all three specimens and compare them with those of *weidemeyerii*, prepared and figured by him in my paper 1914, *Proc. Acad. nat. Sci. Phila.*, **66** : 161, pl. V, fig. 2. This he did, and compared all three with the original preparations which were before him when the published figure was drawn, concluding quite definitely that so far as this criterion may be trusted, all were of the same species as the more eastern *weidemeyerii* and that there was not the slightest resemblance to the genitalia of *lorquini* (represented in fig. 1 of pl. V) such as we should expect to find if this Californian form were a hybrid between *lorquini* and *weidemeyerii*.

I am looking forward to the completion of a further study of the extremely interesting *A. californica–B. lorquini* association, based on the fine material so generously given me by Commander Dammers as well as on that in the British and Tring Museums; also on the material formerly in the Hill Museum, Witley, but recently a valued gift to the Hope Collection. Great additional interest is now supplied by the apparent incipient entrance into this association of the Californian race of *B. weidemeyerii*, as will be made clear by an inspection of pl. XXV of our 1908 *Transactions*. The first and last figures of this plate represent typical *weidemeyerii*, while the remaining figures are of species with an orange apical or subapical F.W. area, so that it is not difficult to appreciate the increased signifi-

cance and interest of this mimetic association, brought about by the change which appears to have now begun.

Since the meeting of 6th June, I have received an interesting account of this new race, written by Commander Dammers, after consultation with Dr. J. A. Comstock, to whom also I extend warm thanks for his kind help.

A little later, on 15 August, Commander Dammers posted to me a female *nevadae* of the form *fridayi* taken on the same day, 25th July, and in the same locality (the Mono Basin) as the three males, by Dr. J. A. Comstock. The butterfly, which arrived in perfect condition, is a wonderful mimic of *B. lorquini*, and thinking that it would be convenient to refer to the resemblance, and also to include Commander Dammers' valuable information, in the communication upon the three males, I have ventured to add this post-dated section.

E.B.P., 8 *October*, 1934.

The following account of the race *nevadae* was kindly sent to me, 12 August, 1934, by Commander Dammers :—

" Barnes and Benjamin described the Californian form of *Basilarchia weidemeyerii* as the race *nevadae*, in their ' Contributions to the Lepidopt. of N. America ' (**5** : 99, 1924). Mr. Jean Gunder, of Pasadena, California, described the ' hybrid ' as a ' transition form intermediate between *lorquini* and *nevadae*,' calling it *fridayi*, in the 1932, Canad. Ent., **64** : 284. He named it after Mr. Friday of Los Angeles, who was the first to capture specimens.

" Dr. J. A. Comstock published some further notes on these new specimens in Bull. S. Calif. Acad. Sci., **32,** Dec., 1933. Dr. Comstock collected both eggs and larvae in the district and sent me one larva which was the only one that came through to imago and was a true *Bas. weidemeyerii nevadae.*

" The type locality of *B. w. nevadae* is the Charleston Mts., South Nevada. It ranges through the Mono Basin in Central California and as far south as the Charleston Mts. How far north it extends we do not know. All the *fridayi* specimens have been taken in a very restricted area in the Mono Basin district. This is beyond my collecting area, being several hundreds of miles North of here."

In the course of the correspondence with my friend Commander Dammers I had expressed the opinion that *B. lorquini* stands apart from the other N. American Basilarchias, as appeared to be shown by Dr. Eltringham's preparations of genitalia referred to on p. 53.* Referring to this opinion, Commander Dammers wrote, in the letter quoted above :—

" I have now raised a quantity of *B. lorquini* and *B. obsoleta* through from egg to imago and one specimen of *B. weidemeyerii nevadae* Edw. The appearance of the larvae and pupae, and the habits of the former in all three species are quite indistinguishable, so much so that I did not take the trouble to paint pictures of *B. w. nevadae* but only remarked that they were the same as the other two. Some larvae of *lorquini*, however, exhibit a tendency to have more brown on them than the other forms." It is very interesting to learn that these three species, one of

* S. H. Scudder, in *Bull. Buffalo Soc. nat. Sci.*, **1875** : 233, separates *lorquini* from the genus *Basilarchia* and places it with *Adelpha californica* under *Limenitis* (p. 250).

which (*lorquini*) exhibits distinct differences in the male armature, should resemble each other so closely in the earlier stages.

The following paragraphs are copied from a letter, written 16 September, 1934, by Commander Dammers :—

" I am glad the specimen arrived in good order. It was the extreme case. Dr. Comstock quotes in Bull. S. Calif. Acad. Sci., **32,** Dec. 1933 : ' While this form is not constant as regards the degree of this [orange] coloring, and ranges all the way from a mere trace, to such an amount as almost to suggest *lorquini*, there is nevertheless one constant feature which separates them from true *lorquini*. This is the absence, on the under surface, of the usual red-brown suffusion of the secondaries. They are in fact, typical *nevadae* with the addition of the *lorquini* patch on the apices of fore-wings.'

" Realizing the importance of breeding them out I arranged with Dr. Comstock to get me a quantity of larvae from that district. It is a long journey and beyond my beat. He went up there especially and had no luck. Apparently the area is very restricted and I do not think there have been more than 20–30 specimens taken in all.

" I think this is the only record of an overlap—anyway Mono Basin is the only Californian locality for *B. weidemeyerii*.

" I might mention that I have one ♀ imago of *B. lorquini* I took near San Francisco that on the upper surface only is identical with the ♀ specimen I sent you on August 15, but underneath is true *B. lorquini*. It has the row of reddish-brown spots outside of the white central band on the upper surface of wings and is therefore *Bas. lorquini*, ab. *eavesii* Hy. Ed.

" I am just back from a most successful trip on the Mojave Desert and found *Papilio bairdii* Edw., and the forms *oregonia*, *brocei*, *hollandii* all flying together. I have a quantity of larvae and all are indistinguishable from the larvae of *Pap. zelicaon* Luc., and readily took to the food-plant of the latter."

My friend Mr. Riley has called my attention to the recent experience * of Mr. C. Brown who, with Mr. Creelman and his son, collected, 13–16 July, 1933, on the W. shores of Mono Lake. They took 130 *B. weidemeyerii nevadae* and 55 *fridayi* : also " a sprinkling of what can be termed straight *Bas. lorquini* Bdv." [I have since heard that three *lorquini* were taken.] He considers that " there is no doubt but that it is a perfect case of cross-breeding between these closely related, yet divergent groups." The three naturalists are to be congratulated on their success in obtaining so large a series of these most interesting forms. The proportion of females, especially among the *fridayi*, would be very welcome information.

Commander Dammers permits me to quote from a very interesting letter written by Dr. John A. Comstock, 4 Oct., 1934, stating that the var. *fridayi* and *B. w. nevadae* do not, so far as he is aware, occur together except " in the region of Mono Lake—a desert area in which oaks do not grow and in which therefore *Adelpha californica* is not found. If *fridayi* is a mimic it would therefore be a mimic of *lorquini*," which, as he writes, occurs in this district and flies with *fridayi*. " Furthermore, there is not a very constant association of the various races of *weidemeyeri* with *lorquini* throughout other ranges. *Weidemeyeri* is a poplar- and

* 1934, *Ent. News*, Phila., **45,** No. 8 : 205, 206.

willow-feeder and hence, in the semi-arid and desert regions, occurs at a lower elevation than does the oak-feeding *Adelpha*. There are many regions in our western states of California, Nevada and Arizona where the ranges of *Adelpha* and the *Basilarchias* somewhat overlap, yet in no other region except Mono Lake do we find this peculiar form, *fridayi*." The mimetic association between *fridayi* and *lorquini*, if, as I believe, it exists, is similar to that known to obtain between species in the same or closely related Danaine or Acraeine genera. In some of these instances mimetic species act also as the models for other species.

The wonderful upper-surface mimetic resemblance of this female specimen of *weidemeyerii nevadae* is not only brought about by the orange-brown at the fore-wing apex; the pale markings of both wings are cream-coloured like those of *lorquini* and not white like the parent form. Observing this in the female I was led to examine the three males more critically and then for the first time realised that the two with the incipient orange apex differed from the third without this development in the very faintly yellowish tinge of the pale markings (see p. 53). The third male exhibited the brilliant white of the more eastern *weidemeyerii*.

Another element in the resemblance to *lorquini* is the pale spot in the F.W. cell upper surface. In the female *fridayi* and two male *nevadae* this spot is quite distinct, although not large as in typical *lorquini*. In the third non-mimetic male it is represented by scattered scales. Thus the colour of the F.W. apex, the tint of the pale markings and the development of the F.W. cell spot, all appeared together in the two males as well as the female, in which also the first two elements in the mimetic approach were immensely emphasised.

It should be mentioned that among 5 ♂♂, 1 ♀ *weidemeyerii* from Colorado in the Hope Collection, the F.W. cell spot was only present in 2 ♂♂ and, in these, smaller than in the Mono Basin specimen which showed the least development of the three. The series of reddish spots beyond the outer border of the pale discal H.W. band, similar to those of *lorquini*, f. *eavesii*, is well developed in the ♀ and faint in one ♂ *nevadae*, but this is a feature which often appears in the more eastern *weidemeyerii*, especially frequently and especially strongly in the females.

In conclusion I wish again to express my warm thanks to my kind friends who have given me such great and unexpected pleasure in studying this new member of the western N. American *Adelpha–Basilarchia* association and in giving me the opportunity of introducing it to our Society.

Mimetic resemblance of a fly (*Baccha* sp.) to a Fossorial wasp (*Trypoxylon*) on Barra Colorado Island. By Prof. E. B. Poulton.

Prof. Poulton said that he had received a letter, written 17 April, 1934, from his friend Dr. J. G. Myers, calling attention to this interesting record :—

" I have just noticed that on p. 155 of Rau's ' Jungle Bees and Wasps of Barra Colorado Island ' is a good account of the mimicry of a *Trypoxylon* by a fly (*Baccha* sp.). Form, colour and behaviour were so exact as to deceive many times Rau, ' who has known *Trypoxylon* in the field for twenty years.' Later he says (p. 156), ' I feel certain that if the swivel-chair naturalists who criticise mimicry so adversely could see the living wings in action, they would at least encourage further inves-

tigation.' It is a pity more of the American entomologists, who are so sceptical about mimicry phenomena, do not go to the Tropics."

Prof. Poulton said that he, too, had noticed this interesting observation in a copy of the book given him by his old friend Prof. James Mark Baldwin; also certain other important notes which he hoped to bring before the Society in the future. Rau's book was warmly commended by another old friend, Prof. W. M. Wheeler, with whom he remembered delightful rambles near Chicago, in the year 1897.

On a Euploeine association on a small island near Santa Isabel in the Solomons; also a further observation on Euploeas attracted by dead leaves of Tournefortia. By R. A. Lever.

Prof. Poulton said he had received the following letter, written by Mr. Lever, 4 March, 1934, at Tulagi, Solomon Islands:—"I am sending a few more Euploeas and a Danaine which I collected last month when in Santa Isabel. They were taken on a very small coral island named Huleo off the southern coast of Santa Isabel. While there I had the good fortune to see a couple of Euploeas feeding on the recently dead, flaccid leaves of *Tournefortia*. Their proboscides were fully extended and they were actively engaged in feeding on the surface of the leaf."

Prof. Poulton exhibited examples of the 21 specimens—all males except the *Danaus*—sent by Mr. Lever, viz. 10 *Euploea* (*Salpinx*) *polymela* Godm. and Salv.; 3 *E.* (*Mestapra*) *fraudulenta* Butl.; 7 *E.* (*M.*) *nechos* Mathew. The single Danaine, a female, *D.* (*Salatura*) *mytilene* Feld., ssp. *decipiens*, Butl., was noted as "Flying with Euploeas." Mr. N. D. Riley had kindly helped in the determination of the Danaine and Mr. A. G. Gabriel with the Euploeines.

The observation upon the two Euploeas drinking from the surface of the dead *Tournefortia* leaves was of especial interest. Although this attraction for male Euploeas had been witnessed by several naturalists,* Mr. Lever's was, he believed, the first definite observation of their actual feeding and the use of the proboscis. There could be little doubt that the two Euploeas were males and it was extremely probable that they belonged to one or two of the three species sent by Mr. Lever from the same island.

***Papilio g. glaucus* L., mutilated and abandoned at Milwaukee, U.S.A.: the hind-wing "tails" as parasemes adapted to protect the vital parts.** By Miss E. A. Oehlenschlaeger.

Prof. Poulton exhibited the two male specimens of *Papilio g. glaucus* L., sent by his friend Miss Oehlenschlaeger, and communicated the following extracts from her letter of 1 Sept. 1933:—

"I have just finished packing two specimens of the 'Tiger Swallowtail,' *Papilio glaucus*, which the Martins do not enjoy as food. One was staggering about

* 1890. *A Naturalist among the Head-hunters*, Lond., p. 94.—C. M. Woodford.
1926.—*Proc. ent. Soc. Lond.*, **1**: 35–7, 48.—Dr. Armstrong, Prof. P. A. Buxton, G. H. E. Hopkins, E. B. Poulton (comments, p. 48).
1927.—*Insects of Samoa*, &c., Brit. Mus. (Nat. Hist.), 3 (1), Lepidoptera, p. 16. G. H. E. Hopkins.
1931.—*Proc. ent. Soc. Lond.*, **6**: 77–80.—Dr. Armstrong, Prof. P. A. Buxton, G. H. E. Hopkins, R. A. Lever, H. W. Simmonds, C. M. Woodford, E. B. Poulton (comments).

among the flowers round the house and thus attracted my attention. Part of the left hind-wing had been torn away, also the 'tail,' but I do not know what bird—if a bird was the culprit—was responsible. The other specimen I found, minus the head and thorax, on the table of our little cactus-house. The left wings had been much mutilated and many pieces scattered by the wind.

"One of my younger friends who is an entomologist of great promise told me of an interesting observation he made some years ago:—A 'Tiger Swallow-tail' had settled and folded its wings into an upright position, when a bird—he did not remember the kind, being more interested in insects—flashed down and snipped off the tails. The bird did not appreciate the flavor and flew away, but the butterfly was captured and provided food for thought. The young entomologist is still wondering whether the tail-like prolongation of the hind-wings of this particular species, or, for that matter, of all 'Swallow-tails,' is a contrivance adapted to protect the head."

Prof. Poulton said that it was of much interest that the theory of parasematic adaptation, as described in 1930, *Proc. ent. Soc. Lond.*, **5** : 16–7, should have independently arisen in the mind of a young naturalist as the result of the actual attack described by Miss Oehlenschlaeger.

Attacks by birds upon moths. By J. G. Myers.

Prof. Poulton communicated the following observations recorded by his friend Dr. Myers, and received with his letter of 3 May, 1934:

"*Burnham Beeches*, 7.iv.28. There was a party of marsh tits—four or five. One dashed to an adjacent tree-trunk, seized very rapidly a small resting moth, flew back at once to its branch—right, left went the wings of the moth, and it was swallowed.

"*Mina Carlota, Santa Clara, Cuba*, 22.iii.34. A common lizard (*Anolis sagrae*) was seen with a large moth (*Mocis punctularis* Hübn.), not quite dead. The moth was carried by the dorsum of the thorax in such a position that the wings were helpless. It is a procryptic species which rests with its half-closed wings in the form of a triangle."

Further observations made in Singapore, upon Geckos and distasteful moths and upon a luminous Coleopterous, probably Rhagophthalmid, larva. By H. N. Ridley, F.R.S.

Prof. Poulton communicated the following notes extracted from a letter, written 20 May, 1934, by his friend Mr. Ridley:

"Reading through my old diary I came across more notes on the Zygaenid (Chalcosiine) moth *Pintia sordida* Walk. and Geckos, which I had quite forgotten. They were made in Singapore some months later than those recorded on pp. 9, 10 of these *Proceedings*.

"12 *March*, 1910.—This evening one of the dark blue and white moths which come to light so often and are uneatable, settled on the table at which I was writing and a brown Gecko caught it by the hind-wings and body. . . . It held it in its mouth for some time but then let it drop. The moth soon recovered and went off, apparently quite unhurt. The Gecko turned away and kept putting its

tongue out as if licking its lips to get the taste out of its mouth. . . . The next evening I threw it another moth of the same kind; after looking at it for some time it seized it by the head and held it for about half a minute and then dropped it. The moth lay on its side with its wings folded over its back, and the Gecko ran away behind the paper-rack. Presently the moth got up and walked away all right.

" This Gecko was *Gecko monarchus*, which lived for a long time in the paper-rack on my table in the veranda and came out every night to eat moths, till one day it accidentally fell to the ground some 20 feet, and having 2 eggs in it, died at once. It is clear that these Geckos take the insects in their mouths gently at first, not crushing them and spit them out if they don't like the taste, so that the moth escapes quite unharmed. The Geckos normally of course feed in the dusk or at night in a wild state so that they could hardly see colour and I suppose must taste the nocturnal things gently first before they bite them up.

" I enclose a life-sized sketch, drawn June 25th, 1908, of the glow-worm which made the dog sneeze, as described on p. 10 of these *Proceedings*. It is rather a rough figure but, as often happened, some one came in and took me off before I could finish it. It has so many lights along its sides that it looks like a P. & O. steamer at night with the lights shining through the portholes.

" The following notes are recorded in my diary for June 25, 1908 :—

" ' Last night I caught a common glow-worm on the path by my house (in the Botanic Gardens) and make the following notes on it. It is active and runs fast at night, coiling up and emitting a musky scent when touched. During the day it remains coiled up and quite quiet. Its lights are arranged as follows :—

Segment 1 : after the head. Two light spots very small in centre of the back; one on leg near the spiracle on each side.
,, 2 : 1 in centre; 1 lateral.
,, 3 : none central; 1 lateral.
,, 4 to 8 : 1 central; one near each spiracle.
,, 9 : none central; one near each spiracle.
,, 10 : one central; 2 to each spiracle.
,, 11 : none central; 1 to each spiracle.'

" I don't know what these glow-worms eat. There were no snails in the gardens except at one spot and there not enough to supply the numbers of glow-worms which were scattered about all over the gardens."

Prof. Poulton, referring to Mr. Ridley's words on the Chalcosiine moths uninjured by the Gecko's attack, said that the toughness and flexibility of these and so many other distasteful insects, together with their great tenacity of life, are of immense importance in promoting recovery from experimental tasting. With reference to Mr. Ridley's account of the luminous larva and his sketch, exhibited to the meeting, his friend Dr. K. G. Blair had written the following note :—

This drawing and the notes appear to refer to a larva, belonging to a genus undetermined in the British Museum, which I consider to be probably a Rhagoph-

thalmid, possibly *Diplocladon*. Males of *D. hasselti* Gorh. were sent to the Museum by Mr. H. N. Ridley, but nothing appears to be known of the female of this genus and it is possible that we have here a case of paedogenesis and that these larvae become sexually mature without ever reaching an adult stage.

In the dried larva it is impossible to recognise definitely the luminous organs described by Mr. Ridley, but in an example from Perak (Sharp Coll.) there is a well-marked light dorsal line and the sides are also light, suggesting a distribution of luminosity from deep-seated centres that would agree well with his description. There is further a large waxy-looking plate on the ventral surface of each abdominal segment from 2nd to 8th which I should expect to form the principal luminous organ, although no mention of them is made by Mr. Ridley. The description of an evidently allied larva may be found in *Trans. ent. Soc. Lond.*, **1865** : *Proc.* 101.—K.G.B.

A fine Nemopterid from the Belgian Congo.

Prof. Poulton exhibited a female *Nemopistha imperatrix* Westw., captured by his friend Miss Vinall at Bongandanga, Basankusu, " fluttering round the lamp on 10 March, 1934." The species—evidently rare in this locality, for Miss Vinall had written that the specimen was unique in her experience—had been kindly determined by his friend Mr. D. E. Kimmins.

A living example of Spiral Segmentation in the larva of *Lithophane* (*Xylina*) *socia* Rott ; (*petrificata* F.). By C. N. Hawkins.

A larva, bred by me from one of about 600 ova, is a good specimen of left-handed spiral segmentation in the 1st, 2nd and 3rd abdominal somites. The ova were laid by a moth taken on 5th April last, by Mr. P. Bainbrigge Fletcher, at Fritham in the New Forest. Except for the fact that all setae are present, and allowing for the difference in the pattern and segments involved, it is similar to the specimen of *Amathes* (*Orthosia*) *macilenta* Hb., described by myself in 1933 *Transactions*, **81** : 225, pl. xx, fig. 4. Unfortunately I cannot say whether there were any other abnormal specimens in the brood, as most of the ova, or young larvae, were distributed amongst friends. So far as I have been able to ascertain, however, this was the only one to show an abnormality. The ova were laid in chip boxes (when sufficient were laid in one box the female was placed in another), and for convenience the boxes were cut up and the pieces with ova upon them placed in glass-topped metal boxes for hatching. In cutting up the boxes some few ova were completely destroyed and it is possible some were merely injured. Obviously the facts are not sufficiently well known to enable any conclusions to be drawn, but it seems worth while to put the case on record.

Dr. W. H. Thorpe gave a résumé of his paper on ' the Biology of *Pantophthalmus tabaninus* ' and illustrated his remarks with the epidiascope.

Paper.

The following paper was read :—

" The biology of Scottish Psyllidae," by K. B. Lal.

Wednesday, 3rd October, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society :—Lieut.-Col. F. M. Bailey, Egmere, Walsingham, Norfolk; Frederick Thomas Baker, City and County Museum, Lincoln; J. Marshall, Empire Cotton Growing Corporation, Cotton Experiment Station, Barberton, Transvaal, S. Africa; Frank Stewart Parsons, Empire Cotton Growing Corporation, Cotton Experiment Station, Barberton, Transvaal, S. Africa.

Obituary.

The death of the Rev. W. F. Johnson, elected a Fellow in 1889 and a Special Life Fellow in 1923, and of Mr. C. B. Holman-Hunt, elected a Fellow in 1898, was announced.

Exhibits.

The following communications were then made to the meeting :—

A Drosophilid fly milking an *Orthezia*. By Dr. J. G. Myers.

(Communicated by the Secretary.)

On the 11th January, 1929, at St. Augustine, Trinidad, I found a very heavy infestation of a small *Orthezia*,* festooning the edges of the thick fleshy leaves of a *Euphorbia ligularia* hedge. Odd females at intervals, or close together, and young of all instars, in places formed a continuous white margin to the leaf. The lower part of the hedge was black with fumagine growing on honey-dew which could have come only from the *Orthezia*, since no other Homoptera were present in sufficient numbers. Numerous flies—Sarcophagids, Tachinids, Conopids and Ortalids—and Hymenoptera—male Mutillids, some Vespids, Pompilids, Ichneumonids and Chalcids—were attracted to the honey-dew. The larvae of several species of ladybirds were probably feeding on the young Coccids. Certainly a small Hemerobiid larva was, for it was covered densely with a great bundle of white skins. Literally hundreds of male *Orthezia* with very long tail-filaments were flying up and down before the infested leaves, or resting on them. Copulation was not observed.

The most interesting member of this assembly was, however, a small Drosphilid fly, either belonging to the genus *Drosophila* or very closely related to it. It hovered in some numbers round the leaves; now and then one would settle, usually just near a large female *Orthezia*, stay immobile for a few seconds and then spring upon the back of the Coccid or on its waxy caudal appendage. It next seemed to take a firm grip of wax and leaf, just near the end of the Coccid's actual abdomen, with its second and third pairs of legs, while the first were held in the air, and then brought down on the back of the Coccid, where they played with a curious lateral motion which I can compare only with the movements of a very lively piano-player, executing a complicated piece of music. The fly was so engrossed in

* I have been unable to obtain a determination of this Coccid.—J.G.M.

this task that I was able to use a hand-lens to observe its movements. The playing went faster and more furious, the fly gave what seemed an impatient flick of its wings, but continued the titillation. Suddenly a turbid-looking droplet appeared at the anus of the Coccid, the fly pushed out a fleshy proboscis and sucked it up, and then resumed its playing. It was rewarded, after a similar lapse of time (several minutes) by another, but smaller droplet. I then caught the fly. Six flies were actually observed in this activity, while a seventh was sucking drops of honey-dew from a small spider's web just below a large Coccid.

The white waxy "tail" (the ovisac) of the *Orthezia* may be as much as 6 mm. long, very thick and solid, minutely longitudinally ridged. The body of the adult female is about 2·4 mm., giving a total length of 8·4 mm. The shorter tails are straight, but with added age and length they curve, with a dorsal concavity. The anus is just at the apex of the abdomen, and thus at the base of the "tail," and it opens dorsally at the beginning of a deepish longitudinal groove, extending down the whole dorsal surface of the ovisac, and probably conducting away the honey-dew which is not sucked up by guests. The turbidity of the drop seemed to me to be due to a thin coating of the waxy powder. The substance of the ovisac, however, is not built up by the deposition of such films, but by the product of special glands which open on the abdomen.

Kannan, writing of *Orthezia insignis*, remarks that it is not much attended by ants, and the "honey-dew is more of a solid nature and little in quantity." (*Report Proc. 3rd Ent. Mtg., Pusa*, 1919, **3** : 857.)

Aggressive parasitism of a millipede by a Phorid. By Dr. J. G. Myers.

(Communicated by the Secretary.)

On a forest path at Mt. St. Benedict, Trinidad, at 5.30 in the evening of 9th December, 1928, I found a huge, smooth, black Julid millipede writhing frantically, much like a disturbed *Typhlops*. The writhings and contortions sometimes threw it completely over, when the paler legs, in close rows, gave the appearance of a pale reptile belly. On closer examination my wife and I found a Phorid fly, *Megaselia juli* * Brues, dashing round it, jumping upon it, and being thrown off by the victim's violent lashings. When we took the latter the Phorid seized the opportunity to spring upon its head, where it remained as we put both into a box. From then until 9.30, when we left it—a period of four hours—the fight went on, with amazing energy on both sides. When we turned the glass-bottomed box down so that the contents were in darkness, activity was apparently unabated, for we could hear the millipede lashing round as furiously as ever. The fly was constantly on the move, with short runs, hops and flights, springing upon the back of the millipede, and running towards the head, leaping off again to avoid, just in time, a crush from the hard, massive coils. Whenever it approached the victim's head its ovipositor (very long) was extended and carried thus for some time. The millipede, for its part, as soon as it felt the fly on its back, coiled and uncoiled with great force and rapidity, at the same time turning that part of its body near the fly sideways, and then crashing it against the adjacent part of the coil. Time and again it looked as though it were trying to crush the fly between the coils.

* Kindly determined by Professor C. T. Brues.

There was decidedly no mere undirected coiling or uncoiling, but a definite repetition of movements, made with extreme force, tending to bring the place where the fly sat into violent contact with the armoured dorsal part of the next coil, but the fly always skipped away in time, and, throughout these manœuvres, managed always to return a little nearer the head, which it sometimes reached, only to be dislodged before we could see that it had accomplished its purpose. Finally the millipede would rear up on a few of its posterior segments and dash its whole body from side to side, turn squirmingly over while two-thirds of its length was in the air, and repeat this with such frantic energy that the box appeared filled with writhing coils and it seemed inevitable that the fly would be crushed. As soon, however, as the millipede floundered more or less flat again, there, on or near its head, was the fly. Always the head was the goal.

Next morning, at 6.30, both seemed somewhat tired. The fly occasionally sprang upon the millipede, was dislodged by a few squirms, and remained quiet for a time. At 7.30 the fight was still proceeding, but very slowly. At 12, when we returned, the Phorid was dead upon the floor, with one wing missing. The millipede was kept alive, supplied with damp leaves, for several days. On the 15th, when we returned from two days' absence, it was dead and already falling to pieces.

A second specimen was found on the same forest path at 5.10 p.m. on the 18th December, writhing furiously, with at least four Phorids attacking it. One was boxed with the host, and the others as they ran over the spot where it had been. One of the flies carried the long ovipositor extended as it ran. We put two in the box with the millipede and left them for the night. Whenever we observed them the fight continued, but less strenuously than in the first case. The next morning one of the flies was dead and the other very weak. Both were removed and one of the separate Phorids put in its place. By the evening (6 p.m.) this was dead also, having tried to oviposit in the still writhing millipede several times during the day. The millipede was dead also, and next day was a seething mass of small Phorid maggots. The head of the host, with the anterior ten segments, had broken off, and the interior seemed packed with maggots. On the 22nd all had pupated, and on the 4th of January the first fly emerged.

On the 25th September, 1930, a third specimen of the same Julid was found at 5 in the evening, on the same forest track, squirming under the attack of at least five Phorids. Two of the flies escaped me, returned to the spot where the millipede had rested, and continued to quarter the ground there, with persistent dog-like regularity.

It is under wet-season conditions that this millipede emerges from its retreat and crawls across the damp path. Whether it does so because it is already sick we do not know, but the case certainly seems one of primary parasitism. Senior-White, however, records a Phorid which appeared to oviposit in Limacodid larvae just before they die from some other cause. (1920, *Spolia Zeylanica*, **11** : 299–302, 1 pl.)

Some rare Coleoptera from Britain. By H. St. J. K. Donisthorpe.

On 27th August, 1934, Miss I. Kirk took a specimen of a Longicorn in her room at 52, Oakhill-road, East Putney. Despite repeated attempts neither I nor Dr. Blair and Mr. G. E. Bryant have been able to identify it.

Hypophloeus fraxini, which I took in great numbers in August, 1934, was hitherto regarded as a great rarity. It was taken first in Britain by Sir T. Hudson Beare and myself in Forest of Dean in August, 1922; I next took one specimen at Bagshot in November, 1931. On each occasion it was found in the burrows of species of *Ips*.

An unusual form of *Nymphalis io*. By J. A. C. Greenwood.

On the 27th July, 1934, a specimen of *N. io* was taken when it flew into a drawing-room at Petersfield, Hampshire. The eye-markings are almost completely obliterated on all four wings, only a small light fleck remaining. A very large proportion of both fore- and hind-wings is thickly suffused with black and the remainder is a tawny red, while the underside is also considerably darker than normal. The form is an extreme and striking one, its appearance suggesting a heavy sprinkling of soot. I have not heard of any similar specimens being taken in the locality this summer.

***Acraea rahira* Boisd. from Uganda.** By Prof. G. D. Hale Carpenter.

The distribution of this species is given in Eltringham's monograph as Angola, Damaraland, Cape Colony, Natal, Transvaal, Mashonaland, N.E. and N.W. Rhodesia, and Portuguese E. Africa. The Hope Department, Oxford University Museum has received through the kindness of Mr. G. L. R. Hancock, F.R.E.S., specimens from Uganda as follows :—Lira, in the Lango district East of the Nile, three males 3.vii.31; River Kizibu, Bulemezi, Buganda, South of L. Kioga and west of the Nile, May 1933 one male; Kakumiro in Bunyoro about 15 miles north and slightly west of Mubendi, one female, 16.x.33. These localities are in the low-lying swampy parts of Uganda, just such localities as might be expected for this well-known swamp butterfly. Although I have spent many years in Uganda I have never found *Acraea rahira* there, and first saw it in Bechuanaland. There are specimens in the National Collection from Lake Mohasi, in Belgian Ruanda east of Lake Kivu, but that locality is apparently an isolated one: I traversed that country during the War but did not see *rahira*. Through the kindness of Mr. F. W. Goodson I am informed that there are no specimens in the Tring museum from localities north of north-east Rhodesia. The records for Uganda therefore greatly extend knowledge of the range of this species.

***Charaxes pythodoris pallida*—a correction.** By Prof. Hale Carpenter.

In the description of *C. p. pallida* on p. 12 of this volume I omitted to state that the type specimen is a male.

Observations made in 1934 on butterflies and their enemies in South-Eastern France. By J. A. Simes.

While in South-Eastern France during the last week in July and the first two weeks in August, 1934, I made a number of observations which appear to be of bionomic interest.

I worked in two centres, namely Digne in the Basses Alpes, and Agay in the Dept. of Var. Digne is well known as one of the most famous resorts in Europe

for butterfly hunters. The whole district is on limestone, and is cut up into a series of hot valleys, some of the latter being mere sword-cuts in the hills. Insects are generally abundant there, and I have never seen a greater profusion than was to be found at the time of my visit. The other locality, Agay, is situated in the volcanic Estérel (between San Raphael and Cannes). The red porphyry hills are low and densely wooded. The flora is not widely different from that of the Riviera generally; but there are numbers of fine cork-oaks, and, a little way up the hill-sides, quantities of tree heath, arbutus, cistus and very thorny Leguminosae.

1. *Female butterflies drinking at water-courses.*—Drinking habits in butterflies are commonly believed to be almost, if not quite, restricted to the males; and the females are not supposed to frequent water-courses. This idea must be abandoned. During the period July 26–Aug. 3, 1934, females of the following Satyrine species were observed at Digne drinking in some numbers :—*Kanetisa cordula* Fab., *Eumenis semele* Linn., *E. fidia* Linn., *Aulocera proserpina* [Schiff.], *Hipparchia fagi* Scop., *Minois dryas* Scop., *Satyrus galathea* Linn., *Coenonympha dorus* Esp., and *Maniola tithonus* L. In addition, the Pierine *Aporia crataegi* L. (one example only) was observed.

The desire for water seems to increase as the female insects become old and worn. The female of *Aporia crataegi* referred to above was the only example of the species met with—evidently the last survivor of a worn-out brood. We saw it morning after morning for three or four days, always drinking at approximately the same spot. Then one morning it was missing and it was not until some hours later that we found its lifeless body floating in a pool at the side of the stream.

Even in the Lycaenidae females occasionally go down to the water. Friends of mine who were at Gavarnie, Hautes Pyrenées, in July last, inform me that they saw several females of *Plebeius argus* L., drinking at water-courses. In July 1924 when collecting at Nans, Var, France, I found that the males of the Theclid butterfly *Laeosopis roboris* Esp., did not come down to the water but three females were observed there. I should add that although there are streams in the volcanic tract of the Estérels we never saw any butterflies of either sex drinking at them.

2. *Butterflies attracted by human perspiration : Digne, Basses Alpes, July* 26 : *Aug.* 3, 1934.—The following species settled upon our clothing, nets, haversacks, or boots. All were males except where otherwise stated :—Satyridae : *Hipparchia fagi* Scop., *Aulocera proserpina* [Schiff.], *Eumenis semele* Linn., *E. arethusa* Esp. (this was so persistent that we called it the "Saucy Arethusa"), *Kanetisa cordula* Fab., *Minois dryas* Scop., *Maniola tithonus* L. (females only), *Coenonympha dorus* Esp. Nymphalidae : *Polygonia c-album* L., *Limenitis camilla* L. Lycaenidae : *Lysandra coridon* Poda. Hesperidae : *Pyrgus alveus* Hb., *Hesperia comma* L., *Ochlodes venata alexandra*, Hemming, 1934.

After we had rested for about 20 minutes, and had thus cooled down, the interest waned. One day I tramped about half a mile along a stony track up a dry gorge. On retracing my steps I noted several Satyrid butterflies settled on the track in spots where my feet had trodden. They remained a very short time, however, and did not return. The attraction had clearly disappeared.

Mr. Collenette has suggested that when butterflies are found drinking, the real attraction may always be connected with some animal excretion—urinary or faecal. My experience seems to negative this view. All the species enumerated above, as well as many others, were found drinking in places where there could not possibly have been any human or animal contamination.

3. *Charaxes jasius* L.—*resting habit.*—Observation on several examples of *Charaxes jasius* L. in the Estérels convinces me that the species normally rests high up in the cork-oaks where the corky bark remains unstripped and there is a considerable growth of lichen. I saw several at different times take up their position in a deep furrow of the cork bark some 18–20 feet from the ground.

Various Satyrid butterflies, notably *Aulocera proserpina* [Schiff.], *Hipparchia fagi* Scop. and *Eumenis semele* L., are fond of roosting in precisely the same situation. Both the Satyrids and *C. jasius* are well protected in this position by their underside tones harmonising with the cork bark, though the actual markings and general arrangement of them are widely different in the above Satyrids and *Charaxes*.

4. *Butterflies attacked by wasps.*—Certain butterflies habitually drank only from damp moss on stones in the bed of the stream. The most notable examples of this preference were *Lycaenopsis argiolus* L., *Leptidea sinapis* L., and *L. duponcheli* Stgr. The underside coloration of these species made them most conspicuous objects on the moss and the common wasp (*Vespa germanica*) was making the most of the opportunity thus afforded. While lunching beside the stream I saw wasps carry off several examples of *L. argiolus* : and I also saw a wasp devouring the moth *Lithosia griseola* Hb. In each case the Lepidopteron was carried away entire.

5. *Bug attacking Zygaenid moth : Digne, July* 1934.—A Reduviid bug, *Rhinocoris cuspidatus* Ribaut, ♀, was found devouring a *Zygaena fausta* L., ♀. This moth belongs to a group with " warning " colours and as such is protected by being relatively unpalatable. Its immunity from attack, however, is clearly only relative; and the observation confirms those recorded by others who have found that many Hemiptera are especially adapted to prey upon distasteful conspicuous insects. The general coloration of this bug was distinctly similar to that of the moth.

6. *Mantis devouring Papilionid larva.*—On Aug. 6, 1934, in the Estérel Mts. I saw a mantis devouring a large larva of *Iphidicles podalirius* L. Two days later I had just marked down three larvae of the same species when a mantis flew on to a twig on which one of the larvae was resting and proceeded towards it. I took the larvae and the mantis flew away.

I caught the first mentioned mantis and one day when I was short of other food for it I gave it a larva of *Papilio machaon* L. The mantis would have nothing to do with this larva although it was left in the box for several days. It is clear, I think, that the secretion in the prothoracic glands of the larva of *Papilio machaon* —probably also the same is true of the other European species of *Papilio* which

feed on Umbelliferae, viz. *hospiton* Géné and *alexanor* Esp.—affords a protection against this predacious insect.

7. *Thomisid spiders capturing butterflies: Digne, July* 26–*Aug.* 3, 1934.—"Crab"-spiders concealed in flower-heads were very numerous at Digne, and I saw many examples of butterflies caught and killed by them. I have brought back in some instances (marked *) the spider and the victim, exhibited to the meeting. The victims noted were :—

**Colias hyale* L., ♀, on *Eupatorium cannabinum.*
Maniola lycaon Rott., ♀ do.
**Maniola tithonus*, ♀ do.
Argynnis daphne [Schiff.], ♀ do.
Coenonympha dorus (both sexes) on a *Mentha* sp.
**Iphidicles podalirius*, ♂, on lavender.

In the case of *I. podalirius*, a fine fresh insect, we saw the whole tragedy. Alighting on the flower-head, the butterfly was clearly in difficulties at once. In a moment it was dangling from an invisible thread about a foot below the flower. My son climbed up the rocks to the plant, arriving there in little more than two minutes after the butterfly had alighted. He found a crab-spider on the butterfly, and though he released the latter at once it proved to be dead. Both butterfly and spider were taken. Dr. A. R. Jackson, who has kindly examined the spiders, informs me that they are certainly THOMISIDAE, but that it is impossible to make any closer determination in dried specimens.

Protective resemblances of Acridians (Orthoptera), etc., observed in the South of France.—At Digne in the Basses Alpes (July 26–Aug. 3, 1934) and at Agay in the Estérel Mts. (Aug. 5–11, 1934) I collected grasshoppers which were tinted like the prevailing rock. The specimens taken comprise both blue- and red-winged species in both areas. These grasshoppers when disturbed did not alight on plants or shrubs but practically always on rock or soil where their colour protected them. Four grasshoppers from the grey limestone rocks at Digne have been identified by Mr. Uvarov as *Oedipoda germanica* Latr. (Charp.), ♂♂♀, and *Sphingonotus* sp., ♀. Five insects from the red rocks at Agay belong to the three species *Calliptamus italicus* L., ♀, *Oedipoda germanica*, ♀, and *O. coerulescens* L., ♀.

Among the stubbles in the Estérels I found quite another form, namely *Oedaleus decorus* Germ., ♀. Rain had fallen and the yellow stubbles had a dappling of green where fresh herbage was appearing amongst the yellow haulm of the wheat. The grasshopper found in these stubbles was tinted green and yellow and was thus wonderfully protected.

Yet another form—*Psophus stridulus* L., ♂♂, was found at an elevation of about 5000 ft. on the Cheval Blanc, Basses Alpes. This insect was almost entirely black, there being only a slight mottling of greenish-yellow on the legs and sides. I observed only two examples (which I took) and I am not able to assert positively that they are specially protected by their coloration. It is significant, however, that the prevailing rock is of a slaty colour; that the grass is green only at the top, and blackish below; and that there was much dead wood (black) lying about.

The two specimens taken flew several times before capture and always alighted in the dead part of the herbage which was of a blackish tint.

While on the subject of protective resemblance I should like to refer to the well-known habit of the Chrysididae (Hymenoptera) of feigning death when touched. A species observed at Digne bore, when in this attitude, a marked resemblance—which may be only a coincidence—to the berry of a shrub which grew in that locality. I exhibit two examples of the species which I took at Digne on the flower-heads of *Eupatorium cannabinum*. Both feigned death in the net, assuming a most curious posture. The insects were curled up into a ball, resting on the dorsal surface of the thorax, with the wings closely folded together. In this position the red area on the abdomen was of course uppermost and looked like the dome of the berry. On both occasions when I first inspected the net I thought I had missed the insect and secured only a berry. The species has been identified as *Stilbum cyanurum* Forst., var. *nobile* Sulz., ♂♂.

It should be added that the Acridians, Chrysids, Thomisid spiders and victims, and Reduviid bug with its victim, referred to in the foregoing notes are now in the Hope Department of the Oxford University Museum.

I am indebted to Professor Poulton for much help in the interpretation of my observations and in the identification of many species. In the latter task he informs me that kind assistance was rendered by Messrs. N. D. Riley, B. P. Uvarov, W. H. T. Tams, W. E. China, and R. B. Benson; and I have to thank each of these gentlemen for his aid.

Swallows capturing butterflies on the wing, and feeding their young on Lepidoptera ; Pentatomid bugs swallowed by Coots. By Mrs. M. D. Brindley.

(Communicated by Prof. Poulton.)

During a 4-weeks visit to Norfolk last summer, I noticed 3 instances of birds taking Lepidoptera.

(1) *Waxham, near Palling : August 29th.*—A cold wet day. I saw a swallow swoop at twice, and the second time catch, a butterfly, which I am pretty certain was *Pararge megera* Linn., though it is just possible it was a Meadow Brown which was also common in the place. The bird simply took the butterfly straight off, apparently swallowing wings and all. Some Cambridge friends of ours have a bungalow close to where we were staying at Waxham, and Mr. T. Wyatt, a keen observer of birds, tells me that earlier in the summer they had two swallows' nests on their verandah and were able to watch the young fed at close quarters. He says that butterflies and moths were brought quite commonly and given to the young, but he was never able to determine the species, as the insects, wings and all, were crammed into the fledglings' throats.

(2) *September 10th.*—I saw a swallow pursue and catch a small moth. I think it was *Plusia gamma* Linn., which was common thereabouts but of course could not be absolutely sure of the species.

(3) *September 2nd.*—I saw a Greater Whitethroat twice chase a small brown butterfly. The bird missed it and I gave chase—unsuccessfully, as I had no net

at the time. I think it was *Hesperia sylvanus* (*Ochlodes venata septentrionalis* Verity), as it flew quickly like a Skipper.

September 6th.—I tried feeding some semi-tame Coots on Hickling Broad, 5 miles from Waxham, with live individuals of the big Pentatomid bug *Piezodorus lituratus*. The experiments were not very successful, as it was windy weather and difficult to get the Hemiptera into the birds' range, and when the weather moderated next day, I could not renew the supply of bugs; but in the two (out of 6 possible) cases in which the bird did take up a floating bug, it swallowed it all right but followed up by shaking and washing its bill in the water for a minute or two—in a way which I, and probably Prof. Poulton also, would call "distastefully" but which McAtee ignores. The other four insects were blown into the reeds and one could not see exactly what happened.

Sparrows feeding their young on the "Cuckoo spit" (Homoptera, CERCOPIDAE). By Mrs. M. D. BRINDLEY.

(Communicated by Prof. Poulton.)

I do not know whether other Fellows have seen a note in the 1st Report on Zoology of the 1933–34 "Ann. Rep. N. Staffs. Field Club," **68 : 125**, by F. Fincher, as follows :—"*House Sparrow.* Several seen on June 20th, 1933, feeding young on frog-hoppers.* They deliberately pecked them out of the 'cuckoo spit' and took a good beakful on each occasion." Our garden is swarming with sparrows and frog-hoppers (and most other pests) but I have never seen any birds attack the "cuckoo spit."

These attacks being apparently unusual or at any rate rarely seen, I wrote to Mr. Fincher who kindly supplied the following details :—

"The incident to which you refer took place at Great Bridge, Staffs, in a small garden which had been allowed to run wild, and was overgrown with Rosebay Willow Herb. I was standing by a window looking into the garden and was thus able to watch the whole affair at about 3 or 4 yards' range without disturbing the birds. The following notes are exactly as I jotted them down at the time.

"'This morning (June 20th, 1933) I watched at very close quarters with field-glasses several House Sparrows pecking away the froth or cuckoo spit with which some of the Willow Herb was infested. During a lull in the proceedings I went out to investigate and as I could see some of the immature frog-hoppers still on the plant I thought at first it was only the froth they were after. Further observation showed, however, that the insects themselves were the objective, as I saw one bird in particular pecking up the small green frog-hoppers which must have been very common from the number it collected in one spot. All that I saw caught were fed to young birds waiting on a nearby branch.'

"The above is the only observation of the kind that I have noticed."

Prof. Poulton said that Mr. Fincher's observations were extremely interesting because they helped us to understand how some new habit may arise and spread. He had often wondered whether Mr. A. H. Hamm's observation on sparrows open-

* Evidently the Homopterous insect *Philaenus spumarius* Fall. *nec* L., which Mr. W. E. China tells me is now known as *P. leucophthalmus* L. (CERCOPIDAE); *spumarius* L. being an *Aphrophora* and synonymous with *A. alni* Fall.

ing the cocoons of the "Lackey Moth" (*Malacosoma neustria* Linn.), in his Oxford garden, by pecking through the leaf and thinnest part of the silken wall (1902, *Proc. ent. Soc. Lond.*, **1902** : xv), had been witnessed in other localities. Also the late Mr. W. Holland's record of the means by which starlings cleared the larvae of *Monima populeti* Treitsch., from *Populus tremula* (1890, *Ent. Mon. Mag.*, **26** : 216). It was probable that—in times of food scarcity, or of unusual increase in the numbers of the enemy or of some insect or other animal rarely or never previously attacked by it, or by a combination of these conditions—the use of new sources of food-supply and the employment of new methods for obtaining it, would, when once initiated, spread through a locality or country, and might finally, by the overlap of generations in time and of communities in space, become, without the help of hereditary transmission, part of the characteristic behaviour of the species. By these means it was perhaps possible to explain the origin of such extraordinary behaviour as that of the African Honey Guide (*Indicator*) which directs the traveller to a wild bees' nest and is repaid by feeding on the scattered larvae.

Attacks by birds on British Lepidoptera. By Prof. E. B. Poulton.

The following interesting records and/or specimens have been kindly sent to me during the past season.

Unsuccessful attempts by a Robin to remove the wings of Aglais urticae (L.).—These interesting observations were made by Mr. F. B. Welch, who wrote :—"Yesterday afternoon (28 Sept., 1934) I noticed several *A. urticae* busy on a plant of *Aster amellus* in my garden at Charlton Kings, Glos. A robin living nearby arrived and seized one butterfly, and flew off to the foot of a neighbouring fence where he tried to tear off the wings preparatory to eating it. Eventually he left the insect which fluttered about in bad condition. The robin then captured 2 other *urticae* in quick succession but failed to remove their wings and abandoned the butterflies as he had the first."

Evidence of bird's attack, on the wings of A. urticae.—Dr. J. G. Myers wrote on 23 May, 1934 :—"Here is one more case of a bird attacking a butterfly in England. 20.ix.26, Ashen, Essex. Saw a Small Tortoiseshell with a semi-triangular peck out of the conjoined front and hind-wing of one side. It had evidently been seized by a bird when the wings were outstretched."

Similar evidence on the wings of Pararge aegeria (L.).—My grandson Christopher Poulton of Rugby School took a male "Speckled Wood," 31 Aug. 1934, in the garden of St. Helens Cottage, St. Helens, I.W. Both fore-wings bear extensive injuries in the same area and roughly symmetrical, the hind-wings much smaller but otherwise similar injuries. This species was commoner than I have ever seen it before, and ranged more frequently and widely into open fields, etc.

Repeated but futile attempts of a Whitethroat to capture a white Pierine butterfly, probably P. rapae (L.).—The President has written, recording three determined attempts witnessed by him about 1.0 p.m., 26 Aug., 1934, at Birchington Kent.

Flying moth taken by Robin.—Mrs. K. J. Grant has told me that she observed the capture of a small whitish moth, probably a Geometrid, about 9.0 a.m., in May 1934, at Wheathampstead, Herts.

The late Mr. T. A. Coward's observation of a Skylark capturing the Gold-tail moth (Porthesia similis Fuess).—On receiving a copy of my note * in our 1931 (1932) *Proceedings* (6 : 90), Mr. Coward replied on 2 Jan. 1932 :—

" Thank you for your courtesy in sending me the reference, which does not, however, require alteration : may I add, your wisdom too, for later experiences may cause anyone to modify his opinion ?

" The observation was made at Rostherne, Cheshire, on July 6th, 1912, when I was with Prof. Tattersall—working at the plankton of the mere. This is part of my note, which may interest you :—

" ' We saw a Skylark fly after and catch a Gold-tail moth, which had flown out of the thorn-hedge. The Lark took the moth to the ground, apparently devoured a portion of it, and then flew off with remainder.'

" Then my note goes on with a quotation from your book † about Gold-tails and Satin moths, and [refers to] the numbers of Gold-tails noticed resting on the stocks of the thorns."

Attacks of Common Wasps upon butterflies : wasp carrying off a spider's prey. By Prof. E. B. Poulton.

I am inclined to think that these attacks may be insufficiently appreciated ‡ and that the wings of butterflies found under flowering shrubs may often have been removed by wasps. Careful examination of the marks at the extreme base would probably settle the question. Further observations would be of much interest, especially if directed to the details of the actual attack and conveyance to the place where the wings are removed and the body carried off piecemeal.

On 31 August of the present year my grand-daughter Penelope Poulton and I watched at close quarters a worker of one of our common wasps at work on a fine " Red Admiral " butterfly which lay lifeless on the drive of St. Helens Cottage, St. Helens, Isle of Wight. How did the butterfly reach this spot ? It was an immense load for a worker of ordinary size. No flowers were near at hand, and it is most probable that the butterfly was seized and disabled while resting on a tree or part of the building and that the wasp and its victim reached the ground together. The butterfly lay on its side and the wasp, quite undisturbed by our presence, was gnawing in the most business-like way, close to the hinges of the left two wings. I regret that I did not wait to watch the rest of the performance, but a human meal was due and when I returned after it, the only remains that could be found were the L.F. and R.H. wings exhibited to the meeting. These had been blown by the wind to the middle and opposite side of the drive respectively. The body must have required at least two or three journeys, and I wish that I had seen them and noted the intervals.

About a fortnight later, after I had left St. Helens, Christopher observed another attack on a female " Small Garden White " which was lying on a path in the same garden. He has given the following account of the performance.

* I may add that I have now received evidence that the Gold-tail moth is sometimes, although evidently very rarely, taken by bats.

† 1890, " Colours of Animals," Lond., pp. 241–3.

‡ Mr. J. A. Simes' observations (p. 66) show how important they may be under certain conditions.

" I was walking along one of the paths and returning in about a minute saw upon it a wasp dealing with a butterfly which it had evidently killed during the interval. Where it caught the butterfly I can't imagine for there was no sign of either when I first passed. However, having heard how interested you were with another wasp chopping up a butterfly, I watched. The wasp balanced one of the wings in a vertical position and then gnawed sideways along the hinge. When the wing had fallen it tried to fly away with the butterfly but found the load too heavy, and so landed about a foot from the first position. Here it chopped off the other wing which also was held vertically, and then removed the legs, cut the body in two and flew off with the front section, a comparatively small load. I then left the spot but returned in about three minutes and collected the remains [exhibited to the meeting]. I am not sure whether I found all the legs, but I did my best. I do not think that the whole incident occupied much over two minutes. The wasp seemed to know exactly what to do, except about carrying or trying to carry away the whole butterfly with only one wing off."

In this account of the wasp's behaviour it is evident that " the wing " referred to included the hind-wing as well as the fore. It is also probable that the object of the short flight was to turn the butterfly over so that the wings of the other side could be dealt with. It is interesting that no attempt was made to raise the wings of the much larger and heavier " Red Admiral."

There are tall herbaceous plants near the spot where Christopher observed the incident, and it is probable that the butterfly was killed on a flower and that the wasp then flew or floated with it down to the path below. I do not know whether the sting is employed in these attacks, but the complete and rapid immobility of the victim suggests that this is probable. The nearly fresh female *P. rapae*, exhibited to the meeting, was sent to me by Miss Godman who found it, 5 Sept. 1934, on the lawn at South Lodge, Horsham. Except for a very small notch in the R.H. wing there are no apparent injuries such as we should expect to find after a bird's attack, and it appears to be not improbable that the butterfly was killed by a wasp which was disturbed before dis-winging its victim.

My friend Dr. Eltringham has sent me the following account of a wasp's success in obtaining prey of a very different kind and in a very different manner :—

" I saw an interesting sight on September 15 [1934] at my brother's house at Missenden. A wasp hovered round a window-frame and found a ' Daddy-long-legs ' fastened up by a spider. The spider was not in evidence, evidently thinking discretion the better part of valour. The wasp cut the threads and the wings away, and then rolled up the body of the fly with its feet and flew away with it. It is the first time I have seen a wasp raid a spider's larder."

Observations on the Thomisid Spider *Misumena vatia* Clerck. By Prof. E. B. Poulton.

The following observations on this " crab-spider " were made close to the entrance to Whitefield Woods, Eastbourne, 17 June, 1934 :—

A large white example, harmonising with a small flower-head of the " Hemlock Water Dropwort " (*Oenanthe crocata*) in the centre of which it was sitting, remained

indifferent to the presence of two active Longicorn beetles of distinct species which were passing to and fro close to it; also of minute Diptera which were equally available. One of the beetles even distinctly "pawed" the spider's abdomen in passing, without evoking any response. I then saw that it was holding a small insect, probably Dipterous, but reduced to a minute black lump. I boxed it and its prey with a part of the flower-head. This was a mistake, as other insects, both living and the remains of prey, are likely to be present, so that a determination of the prey seen to be devoured becomes difficult or impossible. If this species of Thomisid accepts such Longicorn beetles, the observation appears to show that it does not drop a small capture in order to take a much larger one.

A little later, another white Thomisid of about the same size but with rather less of the small red spots on the abdomen, which appear to enhance the cryptic effect, was seen on another flower-head of *Oenanthe*, devouring a rather larger Dipteron. Tapping with a grass-head produced no apparent effect until this was repeated rather roughly when the spider slightly shifted its position. When visited a few minutes later it had dropped its prey which lay, a small shapeless object, on the flower-head. The spider then remained motionless for some minutes, facing upwards with outspread anterior legs, in the centre of the slightly tilted inflorescence. It then turned round and faced downwards and later again upwards, when a small Dipteron, larger than the last one, alighted near it. The spider cautiously crept towards it and seized it. The flower-head and its inhabitants were then boxed. These last observations, carried on after the spider was visited a second time, occupied about 15 minutes between 12.0 and 1.0 p.m. I was interested to see that the spider did not merely lie in wait for its prey but approached it.

The above observations were made in the lane just outside the entrance. A third Thomisid, devouring the relatively large green Sawfly, *Tenthredella mesomelas* L., ♀, was found on the upperside of a bramble leaf in a little clearing just inside the wood, close to the entrance from the lane. It was also white and harmonised with the unopened flower-buds and white undersides of the bramble-leaves.

Two young Thomisids, also white, were collected from another part of the same bramble-bed in the clearing.

The sexes of the species captured by these flower-haunting spiders is of much interest. Although often recorded, as by Mr. Simes on p. 67, and by Dr. B. M. Hobby,* far more extensive data are required, as also of the insects captured by wasps.

The Arachnida found so commonly at the North Cape in July 1933 (1933, *Proc. R. ent. Soc. Lond.*, **8** : 112) and believed to be the enemies which attacked weevils under stones, have been determined by my friend Dr. A. R. Jackson, as the Opilionid, *Mitopus morio* Fab., which "has an immense distribution, including a good deal of the arctic, but not Spitsbergen." On the subject of the method by which the weevils may be devoured (*ibid.* p. 113), Dr. Jackson wrote, 1 Sept. 1934 :—

"I fear I know nothing of the digestive processes of Opilionids. They do not of course *as far as is known* inject fluids through their chelicerae, like spiders. On

* 1930 (1931), *Proc. ent. Soc. Lond.*, 5 (3) : 107–110. See also F. H. Haines, 1933, *J. ent. Soc. S. Engl.*, **1** : 102, 103.

the contrary, these organs are chelate. They are rather highly chitinised and could, I think, easily sever a weevil at the junction of thorax and abdomen. In consequence, the contents of the thorax and abdomen respectively could be sucked up into the pharynx, without invoking the aid of an external digestive ferment."

The Kingbird feeding young on dragonflies and butterflies ; also selecting stingless drones ; the American Goldfinch devouring white moths. By Prof. E. B. Poulton.

My old friend Dr. William Beebe, writing 21 Aug. 1934 from St. George's, Bermuda, has interrupted the work on his exciting and most interesting adventure to tell me of the following excellent print :—

" I take time off from my notes on my half mile dive to call your attention to the photograph in ' Bird-lore,' July–Aug. 1934, **36** : 230, of a Kingbird feeding a butterfly to its young."

My friend Mr. N. D. Riley agrees with me that there is no doubt about the butterfly represented being *Basilarchia astyanax* Fab. The under surface of the L.F. wing and the margin of the R.F. wing upper surface appear to present conclusive evidence. The print reproduces a photograph taken by the author, Raymond S. Deck of New Rochelle, N.Y., whose paper, " My Connecticut Sanctuary " (pp. 226–231), also records the regular feeding of the Kingbirds' young on dragonflies. Thus, when watching one particular nest, the " parents flew down, singly or together, with the inevitable dragon-flies " (p. 227). Also on p. 229 :—" Dragon-flies of many sizes and colors and big black butterflies were the staple diet. . . . I saw practically no inclination to molest the numerous bees and wasps, but no doubt that was because meatier insects could be readily had. Kingbirds—known as ' Bee-Martins ' in the South—often feed largely on honey-bees, usually selecting the stingless drones."

The following observation on the American Goldfinch, pointed out to me by my friend Dr. J. G. Myers, may be conveniently added to the above.

" Last Sunday morning when I came home from church, as I entered my yard I noticed the lilac bush in front of our door was filled with little white moths flitting around. Thinking nothing of it, I went into the house. It was not long before the sun got around to shine on the bush, and this made the moths scatter here and there. A few moments later I heard a bird chirping in front of the house. I walked quietly in the direction of the door, and, to my surprise, there was a Goldfinch devouring those little winged creatures.—Helen Thomas, *Flushing, N.Y.*" (July–August, 1933. *Bird-Lore*, **35** : 238.)

Butterflies attacked by bee-eaters in S.W. India : Protective devices of caterpillar and associated Phytophagous beetle. By Prof. E. B. Poulton.

Prof. Poulton communicated some interesting observations, recorded by E. L. Arnold,* to which his attention had been directed by his friend Mr. J. A. Simes.

* " On the Indian Hills " (New Ed.), Lond., 1893.

The following, made near Calicut, confirm Col. C. T. Bingham's notes on Burmese bee-eaters.*

" Of butterflies when the sun got warm many kinds appeared, the commonest being the small saffron-coloured *Terias hecate*, and the handsome black-and-crimson swallow-tail *Papilio pammon*, which seemed, by the way, to be the principal victims of the graceful green bee-eaters, a pair of which had their perches on the woodwork of a disused well, and every now and then made rapid darts at passing insects. They never missed their prey, and always brought their quarry back to the same spot to be dis-winged before being swallowed, the ground under their watch-towers being thickly strewn with gaily painted shreds of unfortunate butterflies and bees " (pp. 99, 100).

It is difficult to trace the locality of the second observation, apparently made at the author's coffee estate—Pardagherry, reached, by way of Beypore and Palghaut, from Calicut. He describes on pp. 296, 297 a steel-blue phytophagous beetle, about the size of a pea, associated with yellow-and-black caterpillars, one of which, when approached, had " left off feeding, thrown itself back on its rear claspers, and violently swung its body from side to side. At this strange movement, which might alone repel a bird, a gentle vibration has been communicated to the neighbouring twigs and leaves, and the blind-looking beetles have hastily let themselves drop to the ground, where they are quite safe; while, after passing the signal rapidly round the bush, so that every twig at last was in a tremble, the caterpillars would each take a turn round the nearest belaying-pin, and let themselves down after their strange associates by a thousand silken threads."

***Bembex regnata* Parker, preying on Butterflies.** By Robert B. Benson.

This observation has come into my hands through Mr. N. D. Riley and is taken from recent correspondence received at the British Museum from Captain R. H. R. Stevenson of Southern Rhodesia. The Bembecidae (Sphecoidea), as is generally known, do not as a rule seal up the cells containing their larvae, but feed them from day to day on freshly caught insects. The insects caught are generally Diptera, but representatives of other orders are also used. Captain Stevenson records that *Bembex regnata* Parker regularly catches butterflies, usually species of *Terias* (Pieridae) and small Hesperiidae, but sometimes Nymphalinae, for example once *Charaxes etheocles* Cram., ♂, and once *Pyrameis cardui* L., and also once a Hesperid of middle-size, *Abantis zambesiaca* Westw.

Mention should here be made of the observations by Professor G. D. Hale Carpenter recorded in 1917 *Proc. ent. Soc. Lond.*, **1917 :** xli–xlii, where he describes watching a species of *Bembex* preying on Hesperiidae in Uganda. Unfortunately in this case the *Bembex* species was not ascertained as it escaped uncaptured, nor were the butterflies named. In the same part of the *Proceedings*, pp. xxxviii–xl, are recorded observations by Dr. Bondar on the Bembecid *Monedula* (*Stictia*)

* Poulton, " Essays on Evolution," Oxford, 1908, pp. 287, 288. On pp. 282–292 of this work a number of bird-attacks on butterflies are recorded, many of them extracted from the notes of Col. J. W. Yerbury and Col. C. T. Bingham. These and the observations described on p. 282, *n.* 1, were inadvertently omitted in recent discussions on this subject.

adonis Handl., preying on HESPERIIDAE in south-east Brazil with a reference to a previous observation on the storing of butterflies by wasps in Belt, 1880, "The Naturalist in Nicaragua" (2nd edit.): 109.

Some exotic Coleoptera recently taken in Britain. By Dr. K. G. BLAIR.

Two interesting cases of exotic beetles taken at large in this country have recently come to my notice. *Megadytes costalis* Aub., a native of Brazil, was found dead in the mud of a pond at Mill Hill by W. O. Steel, and *Ochotyra testacea* Pasc., a Rhagophthalmid from S. India, was found by Dr. A. H. Newton crawling on the short grass at the top of the cliff near Brightstone, I.W.

Mr. E. C. BEDWELL announced the capture by himself of the Oriental *Anthicus tobias* Mars. in a wood near Malling, Kent.

The true Nature of the Hypopharynx in Blood-sucking Arthropods. By S. K. SEN.

The observations recorded below were made on the tick *Ornithodorus papillipes* and as such, they might, at the first sight, seem out of place at an entomological meeting, although, judging from the contents of entomological text-books and periodicals, the subject of Arachnids does not appear to be excluded from the purview of entomological science. However, as will be seen from what has to be stated later, the present observations apply not only to the tick, but to the entire range of blood-sucking Arthropods and, moreover, they are such as to be quite unexpected and contrary to established views on the subject.

As is well known, the sucking apparatus in ticks is believed to be formed by a pair of chelicerae, or the so-called mandibles, and the hypostome, although an actual mouth-opening has never been observed, nor has it been explained how such dissimilar structures can combine to form the sucking tube. For some time past, I have been carrying on a detailed study of the anatomy of *O. papillipes*, which has been incriminated as the transmitting agent of surra (*Trypanosoma evansi* infection) in India. In the course of these studies, I encountered a stylet overlying the dorsal gutter of the hypostome, the latter representing an extension of the basis capituli. On following up the stylet by dissection, it proved to be, to my great surprise, the tubular continuation of the pharynx itself, and I even succeeded in detaching intact the entire structure, from the proximal end of the pharynx to the distal point of the stylet.

The stylet is provided with a well-defined lumen and a distal orifice and it is remarkably refractile which, perhaps, accounts for the fact that it has escaped observation by other workers. It is resistant to the action of caustic potash and, I think, undoubtedly represents the homologue of the hypopharynx in blood-sucking insects. This discovery at once points to the conclusion that the sucking apparatus in the biting Diptera is not formed by the apposition of the labrum-epipharynx and the hypopharynx as has been hitherto supposed, but that it is a tubular extension of the pharynx itself; that the buccal chamber is not formed by the walls of the exo-skeleton, but is an entity by itself, being entirely separate from the exo-skeleton, except for the intervening connective tissues and chitinous plates; and, lastly, that the lumen of the sucking stylet in biting flies is, in all

probability, what has, till now, been regarded as the hypopharyngeal extension of the salivary duct.

A short communication on the finding of this organ has been forwarded for publication in *Nature* and a detailed paper will be published elsewhere in due course.

Papers.

The following papers were read :—

" A study of the colonisation of *Aphelinus mali*," by H. T. Rosenberg.

" The genus *Pintalia* Stål," by F. Muir.

" Further experiments on coloration and relative acceptability of insects to birds," by F. Morton Jones.

" Notes on the behaviour of the larval communities of *Perga dorsalis* Leach," by J. W. Evans.

" Classification of the sawflies of the family Pterygophoridae," by R. B. Benson.

" The American species of the genus *Trypoxylon* (Hym.)," by O. W. Richards.

Wednesday, 17th October, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society :—Captain Robert Alured Denne, Junior Naval and Military Club, 96, Piccadilly, W.1; S. S. Malik, Kashmir Forest Service, Srinigar, Kashmir, India; Nellie Freebairn Paterson, Department of Zoology, University of the Witwatersrand, Johannesburg, S. Africa; E. Graywood Smyth, Hacienda Cartavio, Trujillo, Peru, South America; Sir Thomas Stanton, K.C.M.G., Colonial Office, Downing Street, S.W.1; C. B. Symes, Medical Research Laboratory, P.O. Box 41, Nairobi, Kenya Colony.

Obituary.

The death of Mr. M. L. Thompson, elected a Fellow in 1901, was announced.

Exhibits.

The following communications were then made to the meeting :—

A dark specimen of *Eumenis semele* L. and a beetle new to Britain. By H. St. J. K. Donisthorpe.

On 1st August, 1933, I took a specimen of *E. semele* which is much darker on both upper- and undersides than any specimen in the British Museum collection of British Lepidoptera.

On 26th June, 1934, Mr. J. R. le B. Tomlin took 2 specimens of *Ebaeus abietinus* Abeille, in Moccas Park, Herefordshire. This record makes an addition to the British List, although representatives of the genus have previously been recorded.

Movements of the ptilinum in newly-emerged tsetse-flies. By D. J. Lewis.

(Communicated by Prof. P. A. Buxton.)

The following notes on the movements of the ptilinum and other parts of the body in newly-emerged tsetse-flies, *Glossina tachinoides* and *G. submorsitans*, illustrate the importance of this organ in enabling the insect to burrow upwards through the soil in which the pupa was buried. A regular cycle of movements occurs which occupies five seconds or less. The head is laterally contracted so that it becomes wedge-shaped and at the same time is pushed forwards. The ptilinum then becomes fully expanded, the compound eyes being forced so far apart that the head becomes broader than the thorax. This is followed by a powerful longitudinal contraction of the body, the head and thorax being pressed tightly together. The ptilinum is deflated, the head is again contracted laterally and the series of movements is repeated. At the initial contraction the area between the eyes is folded and narrowed to a fraction of its normal width (to about twice the diameter of one ocellus). The full expansion of the ptilinum involves the whole head, so that its size is seen to be considerably increased from whatever direction it is viewed. For instance, the whole ocellar region as far back as the vertical bristles is raised above the level of the eyes. During the contraction of the thorax a deep transverse fold appears on each side of the mesothorax.

The evident result of these movements is that the temporarily wedge-shaped head is forced into a space between the soil particles and then becomes firmly fixed there by expansion, after which the thorax and abdomen are drawn after it. A newly-emerged fly placed between sand and glass is seen to move forward only when the ptilinum is expanded, while the motionless legs are drawn through the tunnel bored by the ptilinum.

Six freshly emerged adult *G. submorsitans* were placed beneath one inch of sand (grains 0·2–1 mm.). They rapidly reached the surface, which showed regular movements corresponding to the pushing forward of the head. Four flies in which the ptilinum had ceased to expand failed to reach the surface.

The ptilinum generally continued to expand for more than thirty minutes after emergence.

The number of generations of *Pieris rapae* L. in Southern England. By O. W. Richards.

It does not appear to be very well established how many broods of *P. rapae* there are in this country. South (1906, *British Butterflies*, p. 37) and Barrett (1893, *Lepidoptera of the British Islands*, **1** : 23) state that there are two broods and South adds that in exceptional years there may be a third. Frohawk (1924, *Natural History of British Butterflies*, **1** : 19) states that there are broods in May and July and sometimes one in August–September.

Observations made at the Imperial College Field Station, Slough, Bucks, during the summers of 1932, 1933, and 1934 suggest that there are regularly three broods. In 1934, complete observations on the number of eggs present on a certain row of cabbages were made between the end of April and the end of September (except between 22nd June and 8th July). During these months there were three distinct, non-overlapping oviposition periods, viz. approximately 14th May–21st June, 9th July–9th Aug., 23rd Aug.–2nd Oct. Observations in 1932 and 1933, though not so complete, provide comparable data.

According to Querci (1932, *Ent. Rec.*, **44** : 168–176) *P. rapae* has eight broods at Philadelphia, but the flight periods of all the later ones overlap. The method of counting the number of eggs present would not reveal the existence of such overlapping broods, unless the counts were made on a very large scale. But there is at least little indication of more than three broods at Slough.

Attacks of birds upon butterflies in the Solomon Isles. By Prof. G. D. Hale Carpenter.

The following specimens were exhibited, captured by Mr. R. A. Lever, F.R.E.S.

(1) *Hypolimnas alimena salomonis* Ribbe. A male from Ulawa I. May, 1934. The tips of both fore-wings are rubbed and slightly torn : on the left side there are some sharply-marked scratches and a very clear triangular imprint, visible on both sides, directed from the third vein forwards and outwards towards, and almost reaching, the apex. The line of the mark leads backward to the hind margin of the wing which is broken away posterior to vein 1, suggesting that the beak was passed forwards from the hind margin, and that it was a long one whose tip only is shown on the wing.

(2) *Danaida affinis cometho*, G. & S. A female from Su'u, on the west coast of Malaita Isle, May 23rd, 1934. Both hind-wings are notched, on the left side at the end of vein 3, on the right at the end of vein 4. A large triangular mark, visible on both sides of the wing, commences from vein 4 on the right wing and is directed towards the anal angle, its posterior limb running from the notch on the hind margin. There is also a wide notch on the outer margin of the left front wing, and the upper surface is scratched. Both specimens are in the Hope Department of the Oxford University Museum.

An association of black and white butterflies from Mt. Mlanje, Nyasaland. By Prof. G. D. Hale Carpenter.

A collection has been presented by Dr. W. A. Lamborn, O.B.E., F.R.E.S., to the Hope Department which consists of butterflies captured in May, 1934, " in one ravine on Mlanje Mountain by Bisenti, Neave's former head-collector, who was instructed to obtain black and white butterflies only, for I hoped that I might be able to get a series of the fine black and white *Pseudacraea*. But luck was out." Dr. Lamborn wrote in a letter of later date : " The boy was instructed to collect all black and white butterflies, not specially to concentrate on *niavius*-like forms." This last remark was in answer to a query after first inspection of the consignment, which revealed a high proportion of such forms. The numbers of each species are given in the following table.

Amauris niavius dominicanus Tr., 42.
Amauris albimaculata hanningtoni, Butler, 1.
Hypolimnas dubia wahlbergi Wallengr., 25.
Hypolimnas dubia nr. *daemona* Stgr., 1.
Pseudacraea lucretia expansa Butler, 1.
Pseudacraea lucretia lucretia Cr., 1.
Papilio dardanus cenea, Stoll., ♀ f. *hippocoonides* Haase, 1.
Pseudacraea deludens Neave, 2.
Planema aganice nyasae Carptr., ♀ 5. (♂ 3 not entering the association).
Papilio echerioides Trim., ♀ 1.

The predominant members of the association are *dominicanus* and its chief mimic, *wahlbergi*. The form *expansa* of *Pseudacraea lucretia* fits well into the scheme owing to the enlarged white areas, and the local race of *Planema aganice*,

in the female sex, does so for the same reason. The rarity of the spotted type of coloration at the time of the collection is remarkable: only one *Amauris* was captured. In a paper on *Acraea johnstoni* (1932, *Trans. ent. Soc. Lond.*, **80**: 263) the writer commented on the development of the spots in specimens from Mt. Mlanje, and noted that in Nyasaland "there is a large *Amauris* population with strong white markings of the type shown in *A. dannfelti*." It therefore appears that these numerous spotted *Amauris* were temporarily in abeyance at the time that Bisenti collected: it is also of interest that spotted forms of *Hypolimnas dubia* were also greatly in the minority compared with those mimicking *dominicanus*. The one specimen taken is remarkable on account of the very large white area of the hind-wing which almost equals that of the *wahlbergi*: it comes nearest to form *daemona* Stgr., which is of the *western* race of *dubia*. The submarginal spots on both wings are large and clear: the large discal spot in area 2 has a small white streak behind it in the outer half of area 1*b*, but the remainder of areas 1*a* and 1*b* is without white save for the submarginal dot. There is a slight suffusion with white scales at the extreme base of area 3, in the angle. The white spot in the distal end of the cell is large, and there is a small one nearer to the base.

The two *Pseudacraea deludens* are quite typical: the model for this wonderful mimic, *Amauris lobengula whytei* Butler, was not taken.

The two specimens of *Pseudacraea lucretia* fall under the two headings. The example of form *expansa* shows the great enlargement of the white markings across the disc of the front wing, and also the slight touch of yellow brown at the anal margin of the hind-wing with very large white area, which distinguish this form and cause the specimen to resemble the predominant *Amauris*. The other specimen, although the discal spots of the front wing are somewhat enlarged, is nearer the type, *l. lucretia* than *expansa*, and has the subapical spots of the fore-wing larger in proportion than has *expansa*, so that it more resembles the spotted type of model.

Bird-feeding experiments in 1934, on Martha's Vineyard island, Massachusetts: the return of the "17-year Cicada" to the island: notes on two of its butterflies. By Dr. Frank Morton Jones.

[Prof. Poulton said that the following observations and experiments were described in a letter written by his friend at Vineyard Haven on the island. He felt sure that they would be of the greatest interest to our Fellows and had therefore obtained permission to communicate them to the Society.]

31 *Aug.* 1934.—Bird-feeding experiments have been continued as material was obtainable; but by some shift of bird-populations, nesting birds were not so much in evidence, close by; and most of the insects offered to those present were of species employed in earlier experiments, with results fully in accord. I have just succeeded in trying out one insect, however, for which I have been watching rather anxiously. This is the brightly-coloured day-flying Arctiid, *Utetheisa bella* L. which is one of the four moths illustrated in my forthcoming paper of which you have just sent proofs. In my Florida experiments, results with this insect seemed significant and conclusive; but I wished to try out this widely-distributed insect with northern bird species. Just now, *bella* is appearing in considerable numbers, and I have been able to procure fresh material. In two experiments (August 29 and 31), I placed on the tray moths of the following families:—

Arctiidae	(*U. bella* L.)	10	examples	1	species
Notodontidae		2	,,	1	,,
Noctuidae		19	,,	7	,,
Geometridae		3	,,	2	,,
Lymantriidae		6	,,	1	,,
Yponomeutidae	(*A. aurea* Fitch.)	2	,,	1	,,
		42	,,	13	,,

U. bella and *A. aurea*, as indicated in my second and first papers respectively, are gaudily coloured; all the other moths were of dull greys and browns. The first experiment was terminated in 11 *minutes*, the second in 35 *minutes*. In these periods, the tray was visited by Towhees and Song Sparrows, the former including old birds and young birds sometimes feeding themselves and sometimes being fed. In the stated periods, *all* the dull-coloured insects (30, of 11 species) were taken, and *not one* of either *bella* or *aurea*, though of the former species one insect had been picked up, a front wing torn off, then dropped again on the tray otherwise unmutilated. I'd like to try these insects with the other frequent tray-visitant, the Blue Jay; but of course I cannot control the order of visits of the different birds, and I never know which will come first.

This was "Locust Year"—the year for the appearance of the 17-year cicadas (*Tibicina septendecim* L.)—on the island. They appeared on schedule, in early June, in the same restricted areas they were noted to inhabit, seventeen years ago, and the air was full of their song into early July. Appearing before other cicada species (which too are difficult to procure in numbers), I made no effort to determine their relative acceptability to birds. Though their coloration might be interpreted to have some warning significance, they are of more sluggish habit, rather inactive and of slow and uncertain flight, in comparison with other cicadas. Here on the Island, they inhabit the dry central portion where for many square miles the ground is covered with dense growths of "scrub-oak," which reaches a height of only a few feet. Here the cicadas appeared in countless numbers, and an interesting response to "numbers and availability" (McAtee) became evident: scores of seagulls came inland and coursed over the tops of the scrub-oaks, snapping up the cicadas as they rose from the herbage in clumsy flight. I did not see any actual capture, for the scrub is almost impenetrable; but I did see the gulls engaged in these unusual manoeuvres, and I have no doubt the interpretation put upon these by observers in the local newspaper was correct, and that they were attracted to these inland wastes by the great assemblage of the 17-year cicadas, which too must have been an entirely unfamiliar insect to the gulls.

This summer I constructed a large screened cage over a wild-cherry bush, and have been attempting to breed Basilarchias (*astyanax*) in considerable numbers—thus far without marked success, for more than half of the eggs laid by the females of the first brood develop into hibernating larvae. Here on Martha's Vineyard, white-banded and intergrading forms turn up at intervals, and any considerable series shows interesting and suggestive variations. *Papilio philenor* L., due to the planting of a cultivated *Aristolochia* (*sipho*), is no longer a rarity here, though I believe that in T. W. Harris's time it was supposed to be a rarity in New England. Its survival here (as pupae) through the last winter, with temperatures down to 18

below zero Fahrenheit, shows that its northern distribution is not limited so much by temperature as by food-plant distribution.

The " homing " of a female Noctuid moth, *Luperina testacea* Schiff. By Prof. Poulton.

This remarkable instance of homing was observed by the Registrar who has kindly recorded the details as follows :—

" The moth which I gave to you at the Conversazione was caught by me on 10.ix.34. It has been a regular visitor to a glass door to our house at Hampton Hill for three weeks and always appeared on the same pane of glass at approximately the same time, 9.0 p.m. I am satisfied that the specimen I gave you is the one which visited us so regularly, as I caught, examined, and released it several times during the three weeks. The door faces due south and gives access to the garden in which are a number of fruit trees."

The door contains twelve panes of equal size arranged in three vertical rows of four each, and the moth always settled in one upper corner of the third pane from above in the middle row. It was thus in one of the four most centrally placed corners, but it never chose any of the other three. The most probable interpretation of its behaviour is that it was attracted by light, but the choice of one single corner awaits explanation. This is in fact the only instance known to me of a moth constantly seeking one precise resting-place when thus attracted. All other examples have been of nocturnal insects choosing spots on which to rest by day or of diurnal insects choosing one for rest by night; also of associations of aposematic species joined by late-comers. Prof. Hale Carpenter had suggested the possibility of the glass in the favourite corner being cracked or irregular in some way so as to cause an increased brightness in the light shining through, but the Registrar informs me that he could observe no such effect. He also remembers that the moth returned to the spot very soon after being liberated but the course of its flight was difficult to follow in the light and shade outside the window. He believes that it did not remain on the glass all night, but had not noted the duration of its visits.

Mr. Donisthorpe suggested that the behaviour of the moth might be compared with that of *Coccinella bipunctata* L. described by Miss F. J. Kirk in 1924, *Ent. Record*, **36** : 9–10. These " Lady birds " hibernated in a crevice in the plaster of a bedroom ceiling, and although in warm weather they would leave this and fly about the room for hours at a time, they always returned to the same retreat.

Bees, visiting Orchids at Valescure and in Jersey, captured by Col. G. H. Evans, C.I.E., C.B.E. By Prof. E. B. Poulton.

Col. G. H. Evans in his letter of 1 Oct. 1934, has written the following notes on the specimens exhibited :—

" I am sending you a few bees which M. Berland kindly asked M. R. Benoist, a specialist on bees, to identify.

" *Anthidium septemdentatum* Latr., ♂ : taken on *Ophrys atrata* at Valescure : 3.iii.32. I have only once before seen a bee go to *atrata* ; he extracted the pollen but I was not quick enough to take him. *Ophrys atrata* is, I should say, easily the commonest *Ophrys* in Valescure, and the earliest. I have watched the plants for

hours time and again, without seeing a bee at work on them. I have once taken *A. septemdentatum* on the flower of *Serapias cordigera* at Valescure (1928, *Proc. ent. Soc. Lond.*, **3** : 38).

" *Andrena nigroaenea* Kirby : taken on *O. arachnitiformis*, at Valescure : 3.v.32, I think I sent you a specimen of this bee taken on *O. arachnitiformis*, in 1930 (1930, *Ibid.*, **5** : 102).

" *Anthrophora acervorum* F., ♂ : taken on *Orchis morio* : 11.v.34 : Jersey, C.I. I have watched this plant for many years and have never seen an insect visit it before, but this bee visited 3 or 4 flowers and was not in the least perturbed by my presence.

" The other two bees were taken on *Orchis longibracteata* at Valescure : 9.iii.32. One is *Bombus terrestris* L., ☿, the other *Apis mellifica* L., ☿. These seem to be regular visitors to this plant. I have seen the Carpenter Bee *Xylocopa violacea* L. go to this orchid and extract pollinia, but did not take him. All the bees now sent bore pollinia from the plants noted.

" Watching the bees concerned with the fertilisation of orchids is a very slow business : somehow we have not hit on the time when they visit these flowers. One finds pollinia extracted from any number but can spend hour upon hour without luck."

Bees visiting orchids and captured by Col. G. H. Evans or his friend Col. M. J. Godfery, F.L.S., are recorded in *Proc. ent. Soc. Lond.*, 1928, **3** : 38, 60; 1929. **4** : 106; 1930, **5** : 101; 1931, **6** : 59, 70. References to M. M. Pouyanne's remarkable observations on the fertilisation of Algerian orchids, confirmed and extended by Col. Godfery, will be found in *Ibid.* 1927, **2** : 31; 1928, **3** : 10; 1930, **5** : 49.

The Procryptic Resemblance of a New Zealand leafhopper to its food-plant. By Prof. Poulton.

I am sure that the Fellows will be interested to see the photograph sent to me by my friend Dr. J. G. Myers who wrote from Trinidad on 30 April, 1934 :—

" I enclose a photograph I have just found among my New Zealand records, of a leafhopper (*Cephaelus hudsoni* Myers) on its sole known food-plant, the jointed rush, *Leptocarpus simplex* A. Rich. It is a remarkable case of cryptic form and colouring."

Observations on *Laternaria*. By Dr. J. G. Myers.

(Communicated by Prof. E. B. Poulton.)

In the absence of any modern credible witnesses, the controversy as to the luminosity of insects of this genus is presumably resolved by assuming that Madame Merian's famous observation was based on confusion with *Pyrophorus*. Nevertheless the following alleged record of luminosity may be of interest, while the other observations bear on the recent suggestion of Prof. Poulton that the insect is an alligator-mimic.*

An alleged witness of luminosity.—That very competent zoologist, J. J. Quelch, in his account of the 1898 Roraima expedition prefaced to the second volume of Chubb's *The Birds of British Guiana* (London, 1921, p. xlvi) records the following :—

* *Proc. ent. Soc. Lond.*, **1924** : xliii, xlix. See also *Ibid.* 1927, **2** : 86; 1932, **7** : 68.

" It was quite an event to get a record of the true large lantern-fly (*Fulgora*) in one of these forests of the sandstone plateau. The species is known by the name ' Anarowa ' among the Makushis, and a dead specimen was brought to me by an Indian who had caught it alive in the valley. He had secured it because of the brightness of the light of the enlarged front of the head, to which he pointed; though he had been at first somewhat alarmed by it, as being some sort of kenaima or bad spirit. As the man knew nothing of the disputes as to the luminosity of the species, his testimony must be regarded as valuable and definite, although it is quite possible that the light many be dependent on seasons, as a purely sexual character. Eager search for a living one met with no success."

I took a fine specimen in 1932 in the same forest region. It sat passively on a tree-trunk surrounded by a thick circle of fluffy waxy material from the abdomen, showing that it had certainly not moved for some time, save for rotatory movements probably associated with sucking. Though the insect itself so closely resembled the bark in colour and markings, the *ensemble*, with the snow-white wax was markedly conspicuous. My Macusis, whom I had brought from the savannahs 100 miles to the south, were quite unfamiliar with the insect, and so I was disappointed to secure no traditional data on alleged luminosity or dangerous qualities. I was, however, impressed by the effect of its appearance on these Indians. They laughed—they laughed hilariously—looked again and laughed, and for several days I received deputations of both sexes to see the insect again. Through lack of a good interpreter I was unable to find what particularly impressed them as funny.

There are several reports that the forest Indians, who are familiar with the insect, hold it in the deepest dread. Thus Schomburgk (**2 : 352**) was told by his Indians " that in the forest at Kuamuta (Pomeroon) there lived an especially poisonous and curious creature of which they were unable to furnish me with a description frightful enough. One day they brought me the awful beast, carefully squeezed between two bits of wood, it was nothing else than the harmless glow-worm, *Fulgora laternaria*."

Martius (**3 : 1115**) produces even more startling testimony. He says that, while they were working on a sand-bank, several Indians, with a loud yell that a Jacarenamboya * was flying round, dashed over from the landward side of the bank, plunged into the river, and dived beneath the surface, where they remained as long as they possibly could. They consider, he states, the insect to be highly poisonous, and they took this course to avoid its bite. He definitely attributes this fear to the alligator-like form.

References.

Martius, C. F. P. von, 1831, Reise in Brasilien . . . in den Jahren 1817 bis 1820 gemacht von Dr. J. B. von Spix. . . . und Dr. C. F. P. von Martius . . . 3ter Theil. München. [This volume was written by von Martius after the death of his colleague.]

Schomburgk, Richard, 1922, Travels in British Guiana, 1840–1844. Transl. by W. E. Roth, Georgetown, 2 vols.

* Lingoa-geral, *Jacarenamboia* = alligator-snake. *Jacare* is strictly speaking a caiman, not a true alligator.

Lepidopterous larvae accepted and refused by the Pentatomid larva *Picromerus bidens* L. (Hemiptera). By Joseph Collins.

(Communicated by Prof. E. B. Poulton.)

A larva of the Pentatomid bug, *Picromerus bidens*, taken at Yarnton, near Oxford, on the evening of 15 June 1934, was placed in a glass-topped box already containing a nearly full-grown caterpillar of *Vanessa atalanta* L. On arriving home I found that the bug had pierced the caterpillar with its proboscis and was sucking it dry. On the following evening I collected various Lepidopterous larvae—*Arctia caja* L., *Porthesia similis* Fues., *Abraxas grossulariata* L., a green Noctuid, and *Aglais urticae* L. Early in the morning of June 17 I looked at the tin box in which all these caterpillars had been kept with the bug, and found that the latter had attacked only the *urticae* which was hanging limp from its food-plant. The *similis* and Noctuid larvae were then separated and kept with the bug for a day but were untouched. The bug was then transferred to the box containing the other larvae, to which a nearly full-grown larva of *V. urticae* had been added : this was soon devoured. Further transferences of the bug from one box to the other were made but no other larva was attacked, and finally the *similis* and *caja* caterpillars spun their cocoons in the presence of the Pentatomid. In an earlier experiment of this kind I reared the larva of *Picromerus* on house-flies, removing one wing to enable the bug to reach them. The Pentatomid imago emerged but was below the normal size.

Some Observations on Lepidoptera in East and Central Africa. By Cynthia Longfield.

On 25th January, 1934, while catching butterflies and dragonflies frequenting a small water-course on a coffee estate near Thika, Kenya, I and three companions saw a male of the common *Anax imperator mauricianus* Ramb. seize a passing female *Acraea encedon* L. Instantly after having seized it by the body, it was dropped, and I picked it up as it lay as if dead. Our presence certainly had not caused the dragonfly to release its prey, as we had none of us moved during the episode, moreover the *Anax* had been hawking up and down, just out of reach of my net, for half an hour previously, and continued to do so for some time afterwards, until finally knocked down by one of the planters with me.

A ♀ *Danaus chrysippus* Linn. form *chrysippus*, was taken near Lake Naivasha, Kenya, on Feb. 6th; it shows a long, pointed beak-mark across the torn left wings. Several species of insectivorous birds were numerous, but I did not actually see one attack a butterfly.

On 30th January Miss Fountaine and I were collecting dragonflies at a small swamp by the roadside at Meru, Kenya, close to the edge of Thoura Forest, near a little pool, when a freshly emerged specimen of *Papilio demodocus* Esper alighted on the mud at the edge of the pool. Instantly a large frog or toad leapt from the water, seized the butterfly and began slowly to devour it, wings and all. I ran across at Miss Fountaine's call, to find half the *Papilio* already gone, head first, and in about 4 seconds it had been completely swallowed, and the frog returned to the pool.

I should say the frog sat quite 3 inches high on its haunches, and it may quite possibly have been *Rana fuscigula*, common all over Africa.

On 17th February I was in the Budongo Forest, Uganda, when I saw 4 or 5 *Tirumala petiverana* Doubl. & Hew. fluttering in an excited manner about a clearing caused by the fall of a giant mahogany tree. Owing to the tangle of branches on the ground and the height the Danaines were flying, I was only able to capture two specimens. Both are males and had the brushes at the end of the abdomen fully extruded, and the scent pockets wide open, when caught. The pockets are still open a little, but the brushes were retracted at death. I could detect no scent whatever but have little doubt that a female was present, as one butterfly spent most of the time resting on the foliage of a tall tree, and only taking short flights when approached by another, but she was too high up for me to capture. At no time did I see the brushes returned to the pockets; neither did I see any acceptance by the supposed female, but possibly my presence disturbed them, or the four males got in each others way.

In the same district in Uganda I took a few males of a Satyrid butterfly *Ypthima albida* Butler, which had a peculiar manner of flying. Only one pair of wings were open at a time. The hind-wings were spread, while the fore-wings were closed over the back, giving an uncertain and weak flight. I witnessed this peculiarity on three separate days in all specimens I saw in flight.

In the same Budongo Forest was a small rocky gorge with a swiftly running stream at the bottom. On a vertical rock wall, 4 or 5 feet above the water, and absolutely dry, I found on the 18th Feb. a small assemblage of *Atella columbina* Cramer, all sitting motionless in full sunshine, with their wings closed. I could see nothing on the vertical rock to attract them, I caught 3 and they were all males. Five days later I again visited the place, and this time there were seven *Pseudargynnis hegemone* Godart on the same area of rock. They were "fluttering" their wings violently and after disturbance returned quickly and resumed their "fluttering." I took 3 specimens and they prove to be all males. I can offer no explanation of the attraction of this bare patch of grey rock on which the bright orange of both species was very conspicuous.

While selecting specimens, mostly consisting of Pierines, Danaines, Papilios and Lycaenids, from a large gathering of butterflies at a ford, I was attracted to a specimen of *Papilio pylades* Fabr., because, although unmistakably a *Papilio*, it never once "fluttered" its wings while drinking. This was so unlike what I knew of species of *Papilio*, that I watched it a long time before capturing it. It is a male and the only one I saw. Dr. Longstaff mentions 3 out of 13 species of *Papilio*, in his book, which do *not* "flutter" their wings, but *Papilio pylades* is not among them.

Dr. H. Eltringham gave a description of the brush-organs in *Lithosia griseola* ♂, and illustrated his remarks with a wax model and a lantern slide. He called attention to the interesting fact that this species afforded the first recorded British species in which there is a dust-producing apparatus analogous to that frequently found in exotic Lepidoptera. Fuller details will appear in a paper to be published in the *Transactions*.

Wednesday 7th November, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society:—Dr. Alfred Ernest Cameron, 8, West Savile Road, Edinburgh; Thomas Wallace Chorley, The Agricultural Laboratory, Kampala, Uganda; Walter Dannatt, 94, Guibal Road, Lee, S.E.12; Dr. R. U. Hingorani, M.B., B.S., L.M., 8, Harley Street, W.1; Edward A. Lee, 60, Dawnay Road, Wandsworth Common, S.W.18.

Obituary.

The death of Mr. A. H. Martineau, elected a Fellow in 1897, was announced.

Exhibits.

The following communications were made to the meeting:—

Butterflies attracted to Dung, Sweat and Water. By M. J. Norris (Mrs. O. W. Richards).

Some butterflies taken in the Austrian Tyrol while drinking at dung, sweat and water were exhibited. Full details of these observations have been published in 1934, *Entomologist*, **67** : 280–283. Although water-drinking is so prevalent in the Alps it seems to be a comparatively rare occurrence in this country. There are a few records of Pierines and Lycaenids drinking on very hot days in places near the south coast. Visits of butterflies to patches of dung have, however, seldom been recorded. On one excessively hot day during the July heat-wave this year several such assemblages were observed near the river bank at Goring-on-Thames. At 10.45 a.m. a small crowd of butterflies was seen on a patch of dried cow-dung. At one time there were five male *Pieris rapae* and one male *P. napi* present; one *Aglais urticae* joined them for a minute. All were sucking hard at the dried surface of the dung. At 2.45 p.m. on the same day two male *Lycaenopsis argiolus* were seen sucking on a small piece of bird-dung. Another patch of dry horse-dung was also seen to be visited by two male *P. napi*, one male *P. rapae*, and three male *Polyommatus icarus*. No dung visitors were seen on any other day although the weather had been, and continued to be, very hot.

Mimics and parasites of the Honey Bee in Africa. By Prof. G. D. Hale Carpenter.

I have received the following notes from Mr. T. W. Chorley, of the Agricultural Laboratory, Kampala, Uganda, who has recently become a Fellow.

The Syrphid (*Eristalis plumipes* Bezzi) can always be found hovering around bee-hives, and its presence indicates that a native hive or a nest of bees in a tree is near.

In the case of a European hive the fly settles on the alighting-board and is accepted by the bees; it can often be seen in the hive during manipulation.

The Italian bees from imported queens do not accept the Syrphid so readily as the native bees, but often sting them and take them outside the hive.

The flies are very active and cannot easily be caught away from the hive, but they can easily be caught on the alighting-board. On entering a hive their movements are rapid and they rush in in the same manner as a bee does.

Inside the hive they have been found trying to pass the queen excluder, and they emit squeaks resembling those made by a queen bee a short while before swarming. It is possible that they come to rob the hive either of pollen or honey as they have been observed with their heads inside the cells. When trapped, in a queen and drone trap, on attempting to leave the hive, their excreta closely resembles that of worker bees which have been feeding on honey, and it is also possible to note them voiding this excreta when hovering. From the similarity of this excreta to that of honey-feeding workers it is probable that the flies have been stealing the honey.

When a person approaches a hive of bees a number of these flies will fly at him emitting a buzz indistinguishable from that of angry bees. This is somewhat disconcerting especially as the African bee is distinctly vicious, and, without experience, it is difficult to know whether bees are attacking or merely harmless flies.

When handled the fly curves the abdomen downwards as if attempting to sting and sometimes buzzes on a note indistinguishable from that of a bee.

There is no indication that the Syrphids are parasitic, they appear to be just robbers, but the Tachinid *Rondanioestrus apivorus* Vill. is present as in South Africa (Brain, C. K., 1929, " Insect Pests and their control in South Africa," p. 397). In Uganda there are a few small points of difference in habit, the larva emerges from the anus of the bee and not from between the abdominal segments. The native bee does not die before the emergence of the parasite, as occurs in South Africa, but rushes madly about while the parasite is emerging and dies shortly afterwards. The fly will deposit live larvae in test tubes, and as many as 180 have been deposited by one fly.

A second parasite is a Conopid *Physocephala microvena* Brun. which attacks Italian bees but has rarely been found to attack the native bee (*A. m. andersoni* and *A. m. unicolor*). It has exterminated one hive of Italian bees. The parasitised bees are carried out of the hive and found dead on the ground. Bees collected in front of the hives are found to contain larvae or puparia according to the length of time they have been lying there. The spiracular processes of the larvae are elongated when they are full grown and the two protuberances are visible on the pupa projecting from the end of the bee's abdomen.

I have consulted the account given by Brain and think that a few remarks will be of interest to Fellows who might not be familiar with the book. The females haunt the hives and deposit young larvae upon the bees as they return to the hives : the larvae burrow through the intersegmental membranes and remain in the abdomen, never destroying alimentary canal or nervous system until the last. Parasitised bees die very suddenly (probably when the nervous system is attacked). The fly attacks bees indiscriminately so that the larvae deposited upon old bees will often not have time to mature, the young bees that play round the front of a hive during the mid-day spell are often attacked, and possibly it is only in these that the larvae

will reach maturity. Brain found that three per cent. of the incoming bees were parasitised.

Mr. Chorley's remarks upon the *Eristalis* pretending to sting remind me of my experiments with an *Eristalis* and a young monkey which, after some hesitation, took a live specimen in its hand, and suddenly released it or threw it down precisely as if it had stung him. On one occasion the fly was rubbed on the ground in the same way as the model (1921, *Trans. ent. Soc. Lond.*, **1921** : 100–12).

Exhibited with Mr. Chorley's specimens were *Eristalis* (*Lathyrophthalmus*) *melanops* Karsch, closely resembling honey-bees taken with them on flowers in the Sese Islands, L. Victoria, by Prof. Carpenter, in 1912. The identifications are by Miss Daphne Aubertin, M.Sc.

Interesting Butterflies from the Sudan–Congo border. By Prof. Hale Carpenter.

Captain I. G. Owen, of the Sudan Defence Force, kindly brought to Oxford a large collection made by him at Bendere, in Bahr-el-Ghazal, on the Nile–Congo watershed on the border of the Sudan and the Congo, and quite near the boundary between the Belgian Congo and French Equatorial Africa. The strongly western affinities of the South Sudan are becoming more and more obvious, and the following specimens which were exhibited are among those captured by Capt. Owen from February to July in the present year.

Papilio dardanus dardanus Brown, ♀ form *niobe* Auriv. The very rich dark orange-brown of all the non-black areas agrees well with the dark orange of its model, *Planema tellus*, the western form *tellus* Auriv.

Papilio cynorta. A female, beautifully transitional from the black and white western form *cynorta* F. to the brown and cream Uganda form *peculiaris* Neave. The subapical patch on the fore-wing is very nearly white : the hind-marginal patch, of the size of that in the western race, is cream yellow, as is also the proximal part of the paler area of the hind-wing, forming a band continuous with that on the front wing. The greater part of the hind-wing, distal to the band, is brown, tending to black at the margin. A specimen almost the counterpart of this, in the Hope collections, was taken by Dr. S. A. Neave in Toro, Western Uganda, 7–9000 ft., Nov. 1912, another locality on the eastern fringe of the great western forest area. The appearance is like that of the transitional forms of *Planema epaea* mentioned below.

Papilio carchedonius, Karsch. A typically West African butterfly, and apparently rare.

Papilio plagiatus Auriv. Capt. Owen took a number of males and females of this little known species. The pattern of the male is like that of *cynorta* form *norcyta* Suff. in which the spot in area 6 of the fore-wing is absent. The ground-colour, however, is a purer black; the white, a purer white. The female has quite a different pattern from that of other members of this interesting group, it is black with a composite white patch in the centre of the fore-wing and another, nearer the base, in the hind-wing. In most examples the margins are unspotted, but a single specimen has prominent submarginal spots on the fore-wing in areas 1*b*, 2, 3, and 5, and an apical spot; on the hind-wing there are less conspicuous submarginal spots in areas 3, 4, 5, 6. The pattern is not suggestive of Danaine mimicry, which

is remarkable in this group, but has a certain resemblance to that of females of the Nymphaline genus *Cymothöe*, also figured by Aurivillius in *Rhopalocera Aethiopica* (cf. Taf. VI, fig. 8 with Taf. IV, fig. 4).

Planema epaea. Attention has previously been drawn to specimens transitional between western and eastern forms (1933, *Proc. R. ent. Soc. Lond.*, **8** : 109), and some of these were exhibited for comparison with the transitional *cynorta* mentioned above. The traditional association of forms of *Pseudacraea eurytus* is exemplified also in this area by pale specimens with the *pattern* of the form *terra* (mimicking *Planema tellus*) but with the pale areas not orange but yellowish or cream coloured as in the transitional *Planema epaea*. Other forms of the protean *Pseudacraea eurytus*, also from Bendere, are of the greatest interest. One, black and white, corresponds more or less with *fulvaria* Btlr. or perhaps is nearer to *tirikensis* Neave. The black and white pattern is typically western, but extends up to the Nile in Uganda. A second specimen is of the form recently named by Ungemach as *youbdonis*, which, as he points out (1932, *Mém. Soc. Sci. nat. Maroc*, **32** : 60) is probably a form of *striata* Btlr., a typically western form. The form *youbdonis* has all the lighter orange-brown concentrated into basal patches particularly large on the fore-wing, the distal parts of the wings being grey-brown. It was described from Abyssinia from a female, but there is a male in the National Collection from Isubu, W. Africa. A specimen which links *youbdonis* with the black and white form first named was taken also at Bendere. The fore-wing, of grey-black ground-colour is strongly tinted with red-brown over the posterior and proximal part : there is a white transverse sub-apical bar very slightly dusted with yellowish scales, not quite so wide as in the first specimen. The hind-wing is grey-black but very largely tinted with red-brown at the base, and with only a trace of white at the costal edge. The under surface of the hind-wing does not show the definite triangle typically exemplified in the first specimen but is nearer the condition of *striata*. It thus appears that *youbdonis* and *striata* are forms of *eurytus* : the whole question of the protean nature of this species requires further anatomical investigation. (See the earlier work by Jordan in 1911, 1er *Congr. Int. Ent., Bruxelles*, 1910, **2** : 385–404.)

The following species, not exhibited, also taken at or near Bendere, and of West African distribution, are worthy of record :—*Charaxes zelica* Btlr., *Cymothöe jodutta ehmckei* Dew., *Mycalesis asochis congoensis* J. & T., and *Larinopoda lircaea* Hew.

Aphnaeus asterius Plötz has been taken by Captain Owen at Lotti, in the south-east corner of Sudan, Mongalla Province.

Further examples of attacks of birds upon butterflies. By Prof. Hale Carpenter.

The following specimens show as clearly as possible, on both sides of the wing, the imprint of a beak.

1. *Acraea doubledayi sykesi* E. Sharpe, a male captured by Captain I. G. Owen at Torit, Mongalla Province, South Sudan, 22 October, 1933. The imprint commences at a break on the hind margin between veins 2–4 and runs near the margin to the costal angle. The extreme tip of the imprint is carried forward on to areas 1*a*, 1*b* of the fore-wing. The specimen is a very fresh one : the injury being unilateral may have been inflicted during flight.

2. *Pararge megera* L. [No data available.] A male found in a collection of British butterflies presented to the Hope Department by Mr. E. F. S. Tylecote. The right fore-wing bears on both surfaces an extremely clear imprint commencing at the apex and running backwards and inwards to vein 1 near the base, where there is a small round perforation. The base of the mark encloses the ocellus. The specimen is a very fresh one and otherwise uninjured. As in the previous case it was possibly attacked on the wing, and the freshness of condition suggests that the butterflies were attacked when they may just have begun to fly, and before full powers were attained. The perforation suggests a beak with hooked tip such as that of a Shrike. Comparison with the figure on 1932, *Proc.*, **7** : 11 is of interest.

The following specimens, also sent by Captain Owen who captured them, were exhibited for comparison. Each bears an ill-defined mark in the shape of a narrow triangle, on one or both fore-wings, directed from the outer margin at veins 3 and 4 across to the costa at the end of the cell, and plainly shown on the anterior surface of the costa. The similarity of appearance and situation, the absence of representation on the under surface, and the rather asymmetrical outline, sometimes slightly curved, of these marks indicated that they were due to the doubling over of the apex of the wing in the net, and were not beak-marks but fold-marks.

A somewhat similar condition in which the mark was much clearer, and more regular, was exemplified in a specimen of *Salamis cacta*, which had been exhibited to the Society on 2 May, 1934, and was discussed as an example of difficulty of interpretation. The very regular character of the mark and its absence from the under surface inclined one to believe that it may have been due to a bird biting on the wing resting outspread on a leaf, but the three obvious fold-marks now exhibited made it possible that in the case of the *Salamis cacta* also the mark was due to folding, but unusually regular and well defined.

The three specimens exhibited are *Euphaedra eleus* Drury, *Euphaedra medon* L., *Euryphene absolon entebbiae* Lathy.

The means by which the resemblance of the British Capsid bug, *Pilophorus cinnamopterus* Kb., to the "Wood ant," *Formica rufa* Linn., is produced. By Mrs. M. D. Brindley.

[Communicated by Prof. Poulton, who exhibited the drawing and stated that Mr. W. E. China and Mr. Horace Donisthorpe entirely agreed with the conclusions of the authoress; also that the paper had been compiled from letters written by his friend.]

1934, *Oct.* 1.—I recently caught an uncommon little Capsid bug *Pilophorus cinnamopterus* which is extraordinarily ant-like. The resemblance is commented on by E. A. Butler in his "Biology of the Heteroptera," 1923. I find that the waist-like appearance is brought about, not as in *Nabis lativentris* Boh., by white lateral markings on each side of the abdomen but by delineation due to white pubescent streaks, and the illusion is carried out by the insect's behaviour. I think Butler is wrong in saying, on p. 470, that it resembles the wood ant in shape. Its shape is quite ordinarily Capsid-like, but it is masked by these white patches which give the idea of a petiolated abdomen like an ant's.

1934, *Oct.* 17.—I am sending a very rough water-colour sketch of the bug, a

rather rare little insect found on Conifers. I took a single example this summer near Thetford. In life it is remarkably like an ant, but the sketch does not show this sufficiently. I think the resemblance is due to the brown and chestnut coloration, the carriage of the head, and of the hind legs with their thickened femora, the deflected membrane of the hemielytra, the incrassated first and second antennal joints and the thin, almost invisible third and fourth joints which give the impression of the short dark hymenopterous antenna rather than of the longer and more slender heteropterous one. The transverse bands across the hemielytra are caused by long pale silvery pubescence, very beautiful under the microscope. There are three British species of the genus:—*cinnamopterus* Kb., on Conifers; *clavatus* Linn., and *perplexus* D. and S., on *Salix* and various other trees. All three are much alike to look at and all three are described by various authors here and on the Continent as accompanying ants, especially *Formica rufa*, but it seems most probable that the bugs suck the juices and also the honeydew of the Aphides in which the ants are also interested. What I am leading up to is that one could make out a good case for supposing that these Capsids were ant-mimics—not perfect yet, but mimics in the making with the raw material all there if the selection was strict enough to bring it out. Of course they must be a hundred times rarer than the ants they consort with. In all three, although it does not look like it in the sketch, you get the impression of the hymenopterous "waist," though it is less strikingly represented than in the larva of *Nabis lativentris*, another bug ant-mimic in this country. The round abdomen is represented by the deflected posterior third of the hemielytra. The curve of the latter catches the light at the hinder margin of the corium. In *cinnamopterus* the cuneus is dark brown without any of the silver pubescence. In *clavatus*, of which however I have been able to examine only the one old faded example, there are a few traces of scattered pubescence on the cuneus but without any pattern. But in *perplexus* there is a neat round spot of pubescence on the cuneus just where the high light would fall if it was the upper part of the abdomen of an ant. As to the "waist," in *cinnamopterus* the corium is the same colour throughout its width, but in *perplexus* the corium is divided obliquely across by the median vein, and the inner half (median half) is chestnut and the outer half darker and fuscous. This variation enhances the impression of a "waist." But in the Museum here there is one *Pilophorus* which has the white pubescent patches on the cuneus as in *perplexus* and yet at the same time has the colour of the corium as in *cinnamopterus*. The latter is supposed to be one of the specific characters. These two species also differ from *clavatus* in the arrangement of the transverse silvery bands on the hemielytra. Thin bands run comparatively evenly across the hemielytra, but in *clavatus* that portion which lies on the clavus does not synchronise with that on the corium. Altogether, *perplexus* is the most finished product of the three, the "high light" on its cuneus being especially convincing. But, oh, how unlike the "set" insects are to the real thing in nature!

Procryptic and mimetic resemblances in N.W. Himalayan insects observed by Col. H. D. Peile. By Prof. E. B. Poulton.

The following interesting examples were extracted from his diary by Col. Peile.

Procryptic Resemblance of a Pentatomid larva to its food-plant.—Col. Peile wrote, 20 Mar. 1933, concerning this larva, of which his coloured drawing was exhibited

to the meeting—" one of the most curious instances I came across was that of a larval form of Pentatomid bug which I took settled on a small shrub whose leaves were green and crimson like the insect. The legs were also green and pink. Curiously enough I never found another like it although it was probably not uncommon there (Mussoorie, N.W. Him.).

" My note at the time of capture runs :—

" Taken at Mussoorie 13 June, 1917 : rose-red and green, on small bush, whose leaves were green and red, in a wood. The legs are green and red. The whole insect is very flat, the main portion almost paper-like. The interesting point is that it was clinging to one of the stems of a small bush with small green and also red leaves."

Mr. W. E. China had written, 13 Nov. 1933 :—" The insect represented in Colonel Peile's letter is the larval form of one of the TESSARATOMINAE, family PENTATOMIDAE, and probably of the genus *Eusthenes*. It is impossible, of course, to give the species, although we have a larval specimen which agrees very well indeed with the figure; but there are many species of the genus *Eusthenes* distributed over southern Asia and these are separated on secondary sexual characters, so that it is impossible to identify a larva unless it has been reared to the adult stage. The red and green colour is the normal colouring of the larva of this type of bug. Whether they always settle on red and green leaves I do not know." Further observations on this subject would be of very great interest.

Procryptic Resemblance of the moth Elphos pardicelata *Walk.* (*Geometrinae*) *to rock surfaces.*—Col. Peile noted in his diary :—" ♀ taken at Mussoorie in the Pumping Station nullah (5,600 ft.) about 10 a.m. It was settled on the face of a rock with wings out-spread, and so nearly resembling the surface that it was not noticed at first. June 23, 1914." The diary also records " a ♂ taken on bush 2 days later," and " a ♂ in good condition, 23 Sept. 1916," both at Mussoorie.

Col. Peile also remembers that, although he was " searching this spot for a small species of Skipper, yet this comparatively large moth remained for some minutes quite undetected."

The Epicopiid moth Nossa (Atossa) nelcinna *Moore, mimicking a Pierine butterfly.*—Col. Peile recorded in his diary :—" A fine specimen of this day-flying moth, taken 20.vi.1913, settled on a stone at side of gorge : Mussoorie, at 5,500 ft. It has an extraordinary resemblance to *Aporia agathon caphusa* [Moore], or (doubtfully) *Delias sanaca* [Moore], both found there (*caphusa* abundant). It settled, as if hiding away, in a hollow among stones by the nullah-bed, and not like *Aporia*." Comparing the specimens in the British Museum collection with the two Pierines, I was led to believe that, upon the wing, the moth would bear a considerable resemblance to both species.

In studying Col. Peile's notes on these Lepidoptera I received kind help from Mr. W. H. T. Tams and Mr. A. G. Gabriel.

Experiments with spiders and the bee-like *Eristalis tenax* Linn. By Dr. J. G. MYERS.*

Prof. POULTON in communicating the paper said that his friend the author had written, 23 May, 1934 :—" I have always been greatly interested in the discrimina-

* As Dr. Myers' interesting notes refer to the foes of British insects, it is appropriate to mention here, especially in relation to wasps as enemies of butterflies (1934, *Proc. ent. Soc. Lond.* **9** : 66, 71–2), Dr. G. V. Bull's description of *Vanessa atalanta* Linn., twice vainly attacked (1927, *Entomologist*, **60** : 7), and that of Mr. K. F. M. Murray, who observed an *atalanta* disabled and unable to fly after a wasp had seized it by the thorax (1926, *ibid.*, **59** : 317).—E.B.P. 18 Feb., 1935.

tion shown by predators, and greatly under-estimated by the opponents of the mimicry hypothesis. I was led to make some experiments some years ago, with spiders and *Eristalis*, which you may think sufficiently interesting for the *Proceedings*. I am sending to you for help because I cannot look up the literature here, and am, therefore, unable to judge how far they are original."

Dr. Myers' results may be compared with the treatment of *Eristalis* by Vertebrate insect-eaters as recorded by Dr. F. E. Beddard,* who found that it was " refused or tried and rejected by several [birds]. Eaten after careful pinching by others." Marmosets were " at first afraid, but afterwards ate many "; lizards of three species ate the insect " without hesitation." These statements are quoted from the table on p. 165, *loc. cit.* Prof. C. Lloyd Morgan † wrote :—" I have satisfied myself by experiments with young birds, that (1) after experience with bees, drones are avoided, and (2) that after similar experience drone-flies are also left untouched." Sir Guy Marshall's experiments with spiders ‡ in Natal were confined to Lepidopterous prey, as were those of Canon St. Aubyn Rogers || at Rabai, Kenya Colony, although on one occasion " a small bee got into the web and was released, great caution being exercised " (p. lxxv).

Spiders and Eristalis. By J. G. Myers.

I do not remember that there is in the mimicry literature a clear statement as to the treatment of the bee-like species of *Eristalis* by spiders. On 18th September, 1926, at Ashen, Essex, I began a few experiments with full-grown females of *Epeira diadema*, but these were largely abortive owing to shortage of material. One spider, which had just successfully swathed a large and powerful moth, retreated with every sign of terror from a largish wasp-like Syrphid. Caged spiders of the same species dropped tumultuously from their webs or perches when a wasp was introduced. On the 28th more material was available—a number of hive-bees (*Apis mellifica*), wasps (*Vespa germanica*), and the Diptera *Pollenia rudis*, *Lucilia* sp., *Calliphora erythrocephala*, and both sexes of *Eristalis tenax*. Webs of full-grown *Epeira diadema* were plentiful in the hedges, and were experimented with *in situ*. In every case the Diptera,except *Eristalis*, and including *Calliphora*, practically the same size but with a much more vigorous buzz, were seized forthwith and immediately dealt a quietus with the Chelicerae. At the other extreme were the wasps, which sometimes caused the utmost manifestation of terror, as shown by instant retreat from the web. Other spiders would seize the web and jerk it vigorously in the direction of the wasp, bee or *Eristalis*, as though to shake it out. Others, or later perhaps the same spiders, would gingerly advance, usually in a very different manner from the impetuous dash upon a blowfly, drawing back suddenly with the fore-legs elevated—an " avoiding reaction "—when the prey made a sudden plunge or emitted an extra strong buzz. Often these tactics would last for so long that the prey succeeded in freeing itself. In some few cases the spider would more or less expeditiously rotate the prey, showing great skill and alacrity in avoiding both the mouth-parts and the apex of the abdomen, and swathe it in silk till complete helplessness permitted a bite

* " Animal Coloration," Lond., 1892, pp. 153, 154, 165, 232.
† " Animal behaviour," Lond., 1900, p. 164.
‡ 1902, *Trans. ent. Soc. Lond.*, **1902** : 319–325. Early experiments also with Lepidoptera are quoted on pp. 325–328.
|| 1916, *Proc. ent. Soc. Lond.*, **1916** : lxxiv–lxxvi.

to be administered. This was usually inflicted near the middle of the dorsal surface —the safest position.

A few days later, with the same species of spider, the following results were obtained :—

Four very large blue-bottles seized and killed without preliminary caution or swathing.

One *Eristalis tenax* put in web of *Epeira* about as large as itself. Much plucking at the web, as though to release the fly. A very gingerly approach, the fly finally carefully swathed. Two more were treated similarly.

One very large blue-bottle put in web of *Epeira* only half its size. Seized at once *by end of abdomen* and held securely, though both wings were free from the web and vibrating powerfully.

One worker-bee was found in an *Epeira* web, alive but swathed.

One wasp (*Vespa germanica*) was finally swathed and then bitten on the dorsal surface near base of abdomen. Swathing was continued and the bite repeated in the same place.

A large *Epeira* was given an *Eristalis tenax*. After a few minutes' hesitation, tapping and springing back, it bit the fly on the head, before swathing.

One bee was gingerly approached and finally swathed.

One large bumble-bee was not tackled in any way.

Some days later another *Epeira*, a large yellow and black species, touched an *Eristalis tenax* gingerly, and finally swathed it with considerable circumspection.

The results may be summed up as follows :—

(1) *Calliphora* and other large Muscoids were treated with no circumspection, but tackled with a tumultuous rush. They were never swathed by full-grown *Epeira*.

(2) Hive-bees and *Eristalis*, if negotiated at all, were nearly always swathed. Both were sometimes shaken in an attempt to free the web of them. Both were treated with the same caution and sometimes allowed to escape.

(3) Wasps were tackled with the same circumspection as bees and *Eristalis*, but sometimes the extreme terror they inspired was sufficient to cause the spider to leave the web.

It would appear that the treatment meted out to a victim depends very little on its size and vigour (save in extreme cases like the bumble-bee), but almost entirely on its species, though the idiosyncrasy of the individual spider is a factor. *Eristalis tenax* was treated like a bee, and not like a fly of the same bulk.

A Reduviid bug mimicking a Braconid, and an Asilid fly mimicking a bee, collected in British Guiana by Dr. J. G. Myers. By Prof. E. B. Poulton.

The following note, dated 7 Aug., 1934, accompanied the specimens exhibited to the meeting, sent by my friend Dr. Myers :—" Under separate cover I am sending a fine mimicry pair. The Reduviid bug has been determined by Mr. W. E. China as *Hiranetis cingulatus* Stål; the Braconid has not been identified." The Reduviid, presenting a marvellously precise and detailed likeness to its model, bears the date " Mt. Roraima, 1932," the Bracon, " Kanuku Mts., Jan. 1934."

" The model of the Asilid fly—the bee *Euglossa fasciata* Lep., determined from a similar specimen by Dr. G. Salt, was captured at flowers of *Heliconia bihai*,

which it pollinates regularly. Wanaina, N.W. District, British Guiana, 9 March, 1931."

The beautiful mimic, *Mallophora fascipennis* Macq.,* ♀ (Asilinae), exhibited with its model, was taken in the same locality 14 March, 1931. Dr. Myers' note is as follows :—" What I thought was the *Heliconia Euglossa* flew by. When it alighted on a stump I saw it was an Asilid. In flight it is exceedingly like the big *Euglossa*."

An aboriginal folk-tale based on the bird and wasp nesting association. By Dr. J. G. Myers.

Communicated by Prof. E. B. Poulton, to whom Dr. Myers had written 19 Oct., 1934 :—

" I recently found a remarkably charming collection of mixed Red-Indian-Negro folk tales by a Miss Owen. They were gathered in Missouri, where the aboriginal element apparently predominated, as certainly in the tale I enclose herewith, which was communicated by an old French-Indian (Iowa tribe) half-breed. I know nothing similar in South American folk-lore, but then I have very little literature here, and my wife, who would know, is in British Guiana, in the interior. There is nothing like it in Koch-Grünberg's fine collection."

1893. Owen, Maria Alicia. " Old Rabbit, the Voodoo, and Other Sorcerers." London, xv + 310 pp., illus. pp. 36–37.

" When the big black witch from Thunderland came sweeping over hill and hollow to fight the witch of the bright Corn Country, the world rang with the sound of her terrible voice and the trees bowed themselves to the ground in terror. In her anger she danced, she whirled, she whistled. She smote the trees, she trampled the prairie-flowers, she scattered the corn-in-the-ear as if it had been blades of grass plucked by a child. She fought the witch of the Corn Country, striking her fiercely. She would have prevailed and destroyed the witch and her country utterly had not a wasp, flung from his nest hung from the bough of an ancient crab-apple tree, stung her in the eye, so that her tears fell, and then she became calm and weak as the weakest of old women. Then it was that the witch of the bright Corn Country was able to chase her back to her own land.

" Now the witch of the Corn Country was not forgetful, nor ungrateful. She took her benefactor, the wasp, in her hand and besought him to ask for whatsoever he desired, promising, at the same time, that it should be granted him. Immediately he answered that he and his wife wished, exceedingly, not to be wasps, whom every one hated, but birds, well-beloved by all.

" At once the wasp and his wife had their wish and became orioles; but, because some of the wasp nature was left in them, they did not build their nests as other birds do, but made grey pockets to hold their eggs, which from afar looked like wasps' nests; and as they did, so do their children to this day."

Prof. Poulton said that the " black witch " was apparently a personification of the destructive storms sweeping down from the mountains. He did not know how far north the nesting associations had been traced, but folk-tales wander and

* This species is considered to be the same as *tibialis* Macq. by Kertész (1909, *Catalogus Dipterorum*, **4** : 250, Budapesth), but Dr. B. M. Hobby is convinced that they are distinct.

there was no improbability in the combination of northern and southern elements in the same story.

The "Viceroy" (*Basilarchia archippus* Cram.) mistaken for its model the "Monarch" (*Danaus plexippus* Linn.). By Prof. R. A. Fisher, F.R.S.

[Communicated by Prof. Poulton, who explained that this interesting involuntary evidence of the deceptive resemblance between model and mimic was quoted from a letter written by his friend Prof. Fisher on 2 Nov., 1931.]

"While I was in the States this summer I had rather numerous opportunities of seeing among Geneticists and other Biologists the beginning of a new interest in selection theory, though the amount of harm the early Geneticists have done is certainly enormous. While out there I took to collecting butterflies, partly as a good excuse for being on my own feet, instead of in someone else's car, and one experience may interest you, as we sometimes still meet with Entomologists who pooh-pooh mimetic resemblances by saying that any tolerably observant creature could tell mimic from model at a glance. Of course such an objection only applies to Batesian mimicry, though this is not usually recognised by the critic. I was very anxious to catch the big 'Monarch' and its smaller mimic the 'Viceroy,' but they only came late in the season, and it was some time before I saw any. The first one I caught was a 'Viceroy' which I duly pinned out, and then asked an Entomologist, who was working in the Laboratory where they had very kindly given me bench-room, which of the two it was. His speciality was grasshoppers, and he unhesitatingly declared it to be a 'Monarch,' and when I remarked that it didn't seem big enough, explained that the size was variable according to the nutritional conditions enjoyed by the larva. Of course when I had caught a few more the mistake was obvious, and we both of us could see numerous differences by which we could have identified the first specimen. However, it was very striking that a mistake should have been made under ideal conditions of observation, on a pinned-out specimen, by a man who must have been quite practised in seeing detailed differences, merely because he had never paid particular attention to that particular distinction. Those who adduce this particular criticism seem to expect a lot of their birds."

Some details concerning the Brassolid butterfly, *Dynastor macrosiris*, its early stages, life-history and food-plants. By Rev. A. Miles Moss.

Of this butterfly, which is a rarity, or still a deficiency, in the great collections of the world, I have a short series of bred specimens. Its larva is obtained on at least three out of a number of arboreal Bromelias.

In accordance with the locality of these plants, growing at all elevations on various trees, nearly always standing in water and invariably above flood-level, the butterfly, in these parts at least, may fairly be regarded as an aquatic species. A subspecific form, or more likely a distinct species, has also been taken at 7000 feet in the mountains between Ecuador and Colombia.

Since these plants are widespread and abundant in similar watery districts, and many of them bear traces of having supported this particular larva during the

previous year or two, I am convinced that the species itself is also widespread, and is actually by no means so rare as it is supposed to be.

Though liable to the attack of at least two hymenopterous parasites in the egg and caterpillar stages, only a few isolated examples of these were noted, and not one of the dipterous parasite which so frequently attacks *D. darius* and *Caligo* sp., laying a cluster of white eggs on the narrow necks of the larvae immediately behind their hard, horned heads.

D. darius can support the loss of thousands of specimens in this way, for it obviously has a succession of broods, and there is perhaps no month in the year when its larva cannot be taken on the blades of our common pineapples in garden or field. With *macrosiris*, however, the case is different, and, after much exploration, I can only conclude that it has but one brood, or possibly two, during the first six months of the year, during the flood-season. In support of this argument, I am able to make the following statements :—

(1) The larval period covers not less than 60 days, while conversely the pupal period is remarkably short, all my 7 butterflies bred from the larvae, whose changes I had carefully noted, emerging in less than 18 days, the second male taking 15 days, 17 hours. They generally emerged by 7 in the morning, the latest emergence taking place at midday. Though " working " with a quiet rocking motion for about an hour subsequently, the actual wing-expansion, as with all such species, is marvellously rapid; they literally leap out to their full tether in much less than 5 minutes. Here on their empty shells they invariably remain suspended till about 5 p.m., at which hour, or a little before it, I had to consign them to the lethal chamber, anxious lest they should batter their lovely blue-black wings, for the slightest touch leaves its mark.

(2) Subsequent examination of their abdomens revealed the fact that in nature, and under ideal conditions, both sexes were destined for an unusually prolonged butterfly existence; that of the male being inordinately large and heavy, and containing much fatty matter, while the ovary of the female was similarly embedded in fat, completely immature, with but 2 or 3 large-sized yellow eggs, so soft that they collapsed to liquid in the attempt to remove them.

If I am correct in my surmise, two interesting questions naturally follow : (1) After what interval of time are copulation and oviposition likely to take place ? The large amount of stored fat in both sexes probably makes feeding, in the ordinary way, of secondary importance. (2) Where do these butterflies live during the remaining 6 months of the year ? During the great number of hours when they are not on the wing, and are never found at rest in the open, I can only suggest that both sexes adopt a hermit-like existence in the innumerable holes and hollows which characterise so many of the gnarled tree-trunks of the *igapó*. If so, they must certainly enjoy an extraordinary immunity from the attacks of bats and lizards, which haunt such quarters in great numbers, not to mention the birds and a host of other foes. Focussing to a point what we know about *macrosiris* and its habits, I emphasise the word when I say that *apparently* the male is somewhat unaccountably rarer than the female. This is not only supported by the scarcity of this sex in collections, but also, I think, by the numerical preponderance of large-sized pupa-cases among the hundred odd remnants that I encountered in my searching. Fruhstorfer, *in Seitz* says " only a few examples are known, mostly of only one sex " ;

and further, referring to the three names of *strix*, *hannibal* and *pharnaces*, assuming them to be sub-species, he says, "Of *strix* only females are yet known"; while of the last-named, mountain, form one male only had at the time of writing been taken, in Bolivia, at an elevation of 2000 m.

Of my larvae the first 4 produced grand big females. This was expected as there is usually a marked disparity between the sexes in the matter of size. The smaller dimensions of my remaining larvae led me to anticipate males, but, to my disappointment, only 2 of the 9 pupae produced adults of this sex.

It is apparent that both sexes are so lethargic and secretive that, allowing for their strange watery locality and their even stranger limitations in the matter of movement, it is perhaps small wonder that they are so seldom seen and caught, and are consequently accounted rare. I refer to their time of flight, presumably the same as that of *darius*, which synchronises with the exit of the bats at sunset and their return, roughly between the hours of 5 and 6.30 both morning and evening in equatorial regions.

Most other dusk-loving butterflies of this group, like *Opsiphanes*, *Eryphanis* and *Caligo* spp., are very frequently drawn from their shady haunts even during the hot and sunny hours of the day by banana-bait. Never, in my experience, is this the case with the species of *Dynastor*, which adopt the life habits of that most moth-like of all true butterflies, the superabundantly common *Brassolis sophorae*. The gregarious larvae of this species spoil our avenues of Royal Palms by reducing half their noble fronds to skeletons; and yet their dull brown butterflies are but seldom seen, for they do not fly by day, and appear to feed only as caterpillars, for they never come to fruit. After flying about the tops of palms and bananas in the dusk for half an hour until it is nearly dark, they are occasionally attracted by the street-lamp, or are drawn into houses when the lights are turned on. On parallel lines, therefore, I think I now have sufficient grounds for inferring that the three known species of *Dynastor* have no appetite for sweets, alcohol or decaying matter; are never seen flying by day, and are so securely hidden away that they are very seldom disturbed by man or beast during their diurnal rest.

D. macrosiris, though less in expanse of wing than some of the great Caligos and Morphos, is, from its exceptionally weighty abdomen already mentioned, certainly one of the heaviest of butterflies in the American continent. The Bromelia plants are very unpleasant things to touch, for they cling to one's garments and their spines quickly draw blood. It is little short of marvellous that these large, smooth-skinned caterpillars can live in such an environment without getting spiked. At first I supposed that they simply bit off the thorns and let them drop, but on careful examination of the excreta, each pellet readily divided up into some 50 large scraps, green as the leaf just eaten, and I have several times detected at least half a dozen pieces of bitten thorn, even to the point, which had passed through the alimentary canal of the caterpillar.

My first larva, found on April 18th, though externally full-grown was not quite full-fed, so next day I was able to watch it consume two or three inches of fibrous blade, thick as stout leather; and it was an education to see it pare down the leaf on each side, and then leave it with a neat point scarce inferior to its original, as though not to draw attention to its ravages. Though sometimes more careless in satisfying the pangs of hunger the usual method of feeding is identical with that of

darius on pineapple blades. While feeding, and especially when preparing to moult, it sheds its pellets of excreta with extraordinary rapidity, for I counted no less than 10 in the space of an hour. These are so loosely held together that, rolling down towards the heart of the plant, they soon congregate in a thick mass, like so much coarse green sawdust, providing a ready clue to the whereabouts of a larva, or at least to its recent activities. After a time it lay still, giving me every facility for making accurate measurements and painting its picture in water-colours.

I found it to be exactly 12½ cm. measured when at rest from its face to the strongly hooked, upturned and bone-like pair of tails. Tapering at the extremities to 1 cm., its elegantly curved body swelled to just half as much again in diameter at the centre. Its dark head was furnished with the customary 8 knobbed horns, but each knob possessed an extra tiny lobe like a glossy cream-coloured egg, a most unusual feature. Though placed symmetrically, one at the tip of each knob facing back over the neck, they at once recalled the white eggs which the dipterous parasite so often lays behind the head of *darius*. As I subsequently found this to be a constant feature with all my larvae, even occurring in the second instar, I began to wonder what purpose these seemingly superfluous ornaments could serve in the economy of nature. I am now of opinion that they are definitely intended to simulate parasitic eggs, and thus discourage any fly from laying its eggs; for here was a larva already "stung," and it would be a waste of energy to lay more eggs and thus seal the doom of her progeny!

The face of the larva, very different from that of *darius*, was covered with short brown plush-like hair, relieved by cross lines in a lighter hue, which by suggesting elevated eyebrows and a drooping moustache above the mouth produced a good likeness to the head of a monkey in miniature.

The general ground-colour of the body was a warm apple-green, but the most striking feature was a series of 7 groups of 20 dark fleshy spines, regularly short or tall according to the position, arranged at intervals along the medio-dorsal line, and set, save for the first and last pair, in three broad and irregular ovals of a beautiful deep but suffused maroon tint. These spines, though soft and bending to the touch, exactly simulated the curving hard black spines which edged the blades of its food-plant.

On April 21st it became considerably reduced in length and thickness, and losing all its green it assumed a semitransparent ochreous hue, with the maroon changed into tones of sepia brown.

I always kept an entire plant suspended by a string from the roof, where it could be watered, and the larvae were reared without any trouble. This specimen now clung to the exterior of a yellowing basal leaf and spun a stout cremaster hillock of silk. From this it hung limply for a period, and then moulted on the 23rd to a very large and bulky chrysalis, which clearly predicted that the butterfly would be a female. On hardening, the pupa became bone-coloured on the wing-front, and was graded down the dorsal area with fine mauve lines gradually deepening to pure sepia on the lateral area of the wings. Bearing a strong resemblance to certain snail-shells often found on trees, it clearly afforded a new and striking example of protective mimicry.

Hardly had I finished my painting when my kind host brought me in a second and smaller larva, which he had found on a narrow-bladed Bromelia up the lagoon.

It was in its 4th instar in all essentials like the adult but of a bluer green and perfectly matched to the colour of the leaf. I afterwards discovered larvae in the 2nd and 3rd instars, which differed only in the matter of size and in the lighter colour of the central groups of spines. Subsequently I took a single very large globular egg, which had once been green, and was laid upon the upperside of a broad Bromelia leaf near the tip. It had obviously been parasitised for its contents had disappeared through a single small hole.

The larva I had painted, after barely 18 days in the pupa, produced a fat-bodied female on the day after I reached Pará, May 10th, which merits a description.

With a black costa to the fore-wing, strongly freckled with ochre, imperceptibly developing into an apical margin of whitish blue, and a single bifurcated white spot near the apex, the main area of the upper surface is an unblemished robe of rich blue-black with a broad suffusion of delicate ash-blue on all the fringed margins. The hairy region of the wings together with the lower thorax and abdomen are dead black, while the head and upper thorax on both sides are relieved by warm brown touched with light ochre.

On the reverse side the whole broad apical area of the fore-wing, marked off obliquely by a narrow, waved, white band, is of a smoky mauve suffusing into ash-blue and olive green, mysteriously touched with white and yellow, and exhibiting an apical spot or two and an adjacent pair of ocelli, all of an intense black set in cadmium. An irrorated " lozenge " of brown runs nearly parallel to the inner margin of the hind-wing, while two obsolete and very minute ocelli, widely apart, are more or less centrally situated.

The remaining area below recalls the fine striation of feathers on the breast of a game bird, being marked by innumerable short wavy black lines on an opalescent ground, altogether a most striking combination in colour and of unique design. The chief difference in the male, besides being smaller and sharper in cut of wing, is that the band separating the apical area is here marked also on the upper surface as a narrow, waved and interrupted belt of suffused cream-coloured scales. It is also blacker above and the opalescence more ruddy on the under surface.

At the request of the Rev. A. Miles Moss, specimens of the various species of *Dynastor* were exhibited by Dr. Karl Jordan, F.R.S., who gave a short survey of the classification of the species as follows :

The genus *Dynastor* Westw. 1851, consists of two sections :—

(1) Hind-marginal area of smooth, pointed, modified scales on underside of fore-wing extends to cell and lower median branch.—Here belongs *D. darius* Fabr. 1775, the commonest species of the genus; distributed from S.E. Brazil, Paraguay and Bolivia northward to Guatemala.

(2) Hind-marginal area of modified scales on underside of fore-wing extends only to submedian vein.—Here belong three species, which evidently replace each other geographically and are very similar in structure, but differ much in colour :

(a) *D. strix* Bates 1862, occurring in the Andesian countries from Bolivia to Mexico and Venezuela; fore-wing with broad white oblique band.

(b) *D. macrosiris* Doubl. Westw. & Hew. 1851, known from French Guiana and the Amazons; upperside almost uniformly blue-black, with or without a narrow, curved, oblique white band.

(c) *D. napoleon* Doubl. Westw. & Hew. 1851, found only in the State of Rio de Janeiro at higher altitudes; fore-wing with oblique band, hind-wing broadly margined with orange.

Papers.

The following papers were read :—

"The genital sterna of the immature stages of *Rhodnius prolixus* (Hem.)," by J. D. Gillett.

"On the brush organs of the male *Lithosia griseola*, Hb.," by H. Eltringham.

"Nesting associations of birds with social insects," by J. G. Myers.

"High Mountain Sawflies of Britain," by R. B. Benson.

"The early stages of *Minoa murinata*, Scop., with a description of the verrucae of the larva," by E. A. Cockayne.

"A revision of the African Telenominae," by G. E. J. Nixon (communicated by N. D. Riley).

Wednesday, 21st November, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society :—H. Abdul Hafiz, B.A., Imperial College of Science & Technology, South Kensington, S.W.7; Howard E. Hinton, B.Sc., Zoological Laboratory, the Museums, Cambridge.

Obituary.

The death of Mr. S. T. Klein, elected a Fellow in 1887, was announced.

Nominations.

The Secretary read the following list of Fellows nominated by the Council for the ensuing year :—

For President: S. A. Neave, O.B.E., M.A., D.Sc.
For Treasurer: Francis Hemming, C.B.E.
For Secretary: A. W. McKenny-Hughes, D.I.C.

For other members of Council :—Professor W. A. F. Balfour-Browne, M.A., F.R.S.E., Professor P. A. Buxton, M.A., Professor G. D. Hale Carpenter, M.B.E., D.M., C. L. Collenette, H. Eltringham, M.A., D.Sc., F.R.S., Brigadier W. H. Evans, C.S.I., C.I.E., D.S.O., G. Fox-Wilson, A. D. Imms, Sc.D., M.A., F.R.S., K. Jordan, Ph.D., F.R.S., R. Stewart MacDougall, M.A., LL.D., D.Sc., F.R.S.E., N. D. Riley, J. A. Simes, O.B.E., W. H. Thorpe, M.A., Ph.D., C. B. Williams, M.A., Sc.D.

Exhibits.

The following communications were then made to the meeting :—

Some butterflies taken in France in June and July 1934. By Rev. E. B. Ashby.

I took the following species at Contrexéville, Dépt. Vosges. *Apatura ilia* [Schiff.] var. *clytie* Hbn., and *A. iris* (Linn.) ab. *iole* [Schiff.], *Euphydryas maturna* (Linn.), *Coenonympha hero* (Linn.), and *Maniola jurtina* (Linn.).

High-mountain Sawflies of Britain. By Robert B. Benson.

Eighteen species of sawflies are at present known to inhabit the arctic–alpine botanical regions of the high-mountains in the British Isles; thirteen of these are new to Morice's * lists of British Sawflies, and four are entirely new species.

Much work has been done during three recent trips to the Highlands of Scotland by a party from the British Museum, when over 7000 specimens, mostly Diptera and Hymenoptera were collected, including over 50 additions to the British fauna and at least 13 new to science. Little is yet known of the native fauna of the mountain tops, but what is, is entirely arctic in nature.

A Mantis preying on a Sphingid. By Prof. G. D. Hale Carpenter.

Miss Vinall has presented to the Oxford University Museum a mantis which Mr. Uvarov has identified as *Polyspilota aeruginosa* Goeze. It was captured in the Haut Congo at Bongandanga, 30 May, 1933, preying on a specimen of the Sphingid *Temnora f. fumosa* Walk. The head of the moth is missing and has presumably been bitten off. The record should be compared with that communicated by Dr. E. A. Cockayne in 1932, *Proc.* **7** : 22.

A migrating Hesperid. By Prof. Hale Carpenter.

Miss Vinall has also presented four specimens of *Rhopalocampta libeon unicolor* Mab., from Bongandanga with the following note. " These appeared in great numbers on 4 February, 1934, and stayed until the 20th. The pots of ferns and boxes of flowers on my verandah were covered thick with them. I could not tell from whence they came or whither they went." The records of migrating *Rhopalocampta* being few the above is an interesting addition. Dr. C. B. Williams in his book (" Migration of Butterflies," 1930) only gives one record for *R. forestan* Cr. and one for *R. unicolor*.

Emergence from the egg of the larva of *Charaxes pelias saturnus* Butl. Recent captures of interesting S. African *Charaxes* and of female butterflies after heavy rain. By H. C. Kenway.

[Communicated by Prof. Poulton, who exhibited the enlarged photographs of the egg and emerging *saturnus* larva.]

179 *Brooks St., Brooklyn, Pretoria.*

1934, *Oct.* 23.—At the beginning of August after a very dry autumn and winter we had 1·83 inches of rain—a most unusual fall for August. This was followed

* " Help-Notes towards the Determination of British Tenthredinidae." 1903–1916, *Ent. Mon. Mag.*, **39–52**.

by a very hot spell, the result being an extraordinary burst of Acraeas, Lycaenids and Hesperids. The most interesting feature was the preponderance of ♀♀. After fruitlessly seeking *A. hutchinsonii* Trim., ♀, for four years, I took five in an hour. *Ch. jahlusa* Trim., ♀♀, are also numerous and both sexes unusually abundant.

On Sept. 8th at 11 a.m. a *Ch. saturnus* laid an egg on a *Schotia* bush just outside my daughter's bedroom window. Platt has recorded *Schotia* as a food-plant in Natal, but I do not know of the tree existing in a wild state within 200 miles of Pretoria. Further, I believe there are only two in cultivation in this part of Pretoria.

The larva emerged on Sunday, Sept. 16th at 4.45. I had asked a Johannesburg friend to photograph the egg, and by a marvellous stroke of luck the camera was actually in position when the emergence occurred. I had just gone to the verandah to welcome some friends when I was recalled by a shout of "He's coming out." The larva had eaten a circular slot and the top of the egg was standing up with the head of the larva clearly visible. He bit the piece off and it fell to the ground. The enclosed enlargements give the whole story. He ate the eggshell down to the leaf before 5.30. Unfortunately, the wind was very strong and the negatives are not as good as they might be but they are, none the less, vastly interesting. What colossal luck it was that he should have chosen that moment to emerge. I netted the branch he was on, but he vanished 15 days after emergence, having just started his third instar.

Another event was the capture, this month, of a freak *Ch. p. saturnus*, ab. *laticinctus* Butl.,—a male with the upperside light areas pale yellow and the dark areas a very pale yellowish-brown. All the paler areas are abnormally large. The underside is normal. It is newly hatched and perfect and is the most extraordinary thing I ever saw in my life. Incredible as it may seem, there was another as white as *brutus* Cram. for which I at first mistook it, but afterwards saw it perch on a rock and show its underside, which appeared quite normal. The two were fighting with a normal male. I spent nearly two hours trying to take the others, but it was blowing half-a-gale and they were very shy and nervous, finally going away down the mountain.

I have just received news of the capture of *Ch. bohemani* Feld., ♂, ten miles north of Louis Trichadt (Northern Transvaal)—a new locality.

Prof. Poulton said that he had been struck by the prevalence of female Lepidoptera in nocturnal flights after rain, during a short stay in Bombay Harbour, 12–15 Sept., 1914. The Lepidoptera "included the females of certain butterflies [NYMPHALINAE] which flew at night and came to light with the moths." The moths taken at light, 1907–9, in Somaliland, by the late Mr. Walter Feather also included a remarkable preponderance of females, as was specially noted by Mr. L. B. Prout in his introduction to the GEOMETRIDAE.* Prof. Poulton had always hoped to be able to correlate the sexes of Mr. Feather's captures with the rain recorded in this paper, and he still hoped that some naturalist would find time to do this work.

* *Proc. zool. Soc. Lond.*, **1916** : 91–182, pls. I, II. For Mr. Prout's note see p. 142; also p. 93 for a reference to the Bombay females (where the year is unfortunately printed 1915), and pp. 94–101 for the Somali rain, recorded during the period over which Mr. Feather collected. This paper is also included as No. 12 in *Hope Reports*, 1913–1922, **10**.

Notes on Dorset Lepidoptera in 1934 ; abnormal epigamic behaviour of a male *Aglais urticae* L. By H. L. Andrewes.

[Communicated by Prof. Poulton, who said that the notes were extracts from a letter written by his friend at Bere Regis, Wareham. It was of much interest to hear of results presumably due to the two wonderful summers of 1933 and 1934.]

1934, *July* 9.—What an astonishing season it is for Lepidoptera; I have never known them so abundant. Micros fly off every little branch one shakes, and the country seems alive with butterflies. I had two pleasant surprises yesterday. In passing through the narrow copse which runs close by my bungalow I saw an *L. sybilla* [*camilla* L.]. I had released a tattered ♂ two or three days previously, but was rather surprised to find it, as I supposed, still about. To make sure I followed the one ride that runs through the copse and soon saw another and subsequently quite a lot. They have certainly established themselves, probably through a stray ♀ last year. My back window (that of my living room) looks on the very part of the copse in which I saw the first, and they could not possibly have escaped notice for 6 years, for I am constantly poking about there; also they are now conspicuous in the adjoining lane. It is jolly to have this lovely thing at my very door. Immediately after this I took a *c-album* L., and then four more; this also is new to my immediate locality. *Paphia* L., too is here, though I think I have noticed one or two before.

Another thing that is about in remarkable numbers is *C. dominula* L.; I have found it fairly common before, but this year it is swarming—it gives quite a tropical touch to the district! One habit that I have not noticed before is that of flying, in the late afternoon and until sunset, round the tops of the oaks, descending lower at times, after the manner of *B. parthenias* L. Several may be seen at a time apparently aimlessly going here and there. But the thing I am really writing about is the following: I was returning in my car from Parkstone on July 6th and stopped at 7.30 p.m. (S.T.) by a little bridge over an affluent of the R. Piddle to see if *dominula* had emerged in the little marshy triangle by the bridge, where its larvae are always plentiful. I leant over the parapet of the bridge and saw one on the wing at once, but the astonishing part of it was that it was being vigorously pursued by a *V. urticae*! I watched for some time and then the moth settled on some sedge a few yards from me with the butterfly, its wings outspread, apparently sitting right on top of it. I speedily approached, but before I could see what was happening off they went again, eventually settling once more out of sight on the other side of a broad ditch. I noted the spot as well as I could and made a détour to get to it, but unfortunately failed to see them again. The performance had lasted for quite three minutes and at no time were the two more than 3 or 4 inches from each other. The *urticae* was simply buzzing round the erratically flying moth all the time. Of course I had no net or I might have captured them and determined the sexes. Altogether it was a most remarkable sight, the outstanding feature being the extreme eagerness of the butterfly.

Prof. Poulton said that it was extremely interesting that the abnormal epigamic behaviour described by Mr. Andrewes should have been displayed by the same species as that observed by Mr. O. H. Latter on 6 June, 1928, and recorded in our

1929 *Proceedings* (**4** : 70). In this instance the male *urticae* was eagerly pursuing a male *A.* (*B.*) *euphrosyne* L. Mr. Andrewes' description suggests that the male was acting as he does when obeying his normal instincts and settles behind the female with his head so near to her hind-wings that he can drum upon them with the antennal knobs. (See 1930, *Proc. ent. Soc. Lond.*, **5** : 99–101, with references.)

Two rare insects from Wicken Fen. By H. St. J. K. Donisthorpe.

In September I took a specimen of *Psectra diptera* Burm. (Neuropt. Hemerobiidae) in cut sedge. Although widely distributed in the Old World, from Siberia, through Scandinavia, to the British Isles and south to Italy, it is extremely rare and only 4 specimens have been previously recorded from Britain. A remarkable feature of the genus is the extraordinary dimorphism in the development of the wings—there being two forms, one with fully developed wings and one with the hind-wings very rudimentary. I am indebted to Mr. D. E. Kimmins for the identification of this insect.

I have also taken 3 specimens of the Capsid *Cyrtorrhinus geminus* Flor. in September at the same locality. Only a few specimens have been taken previously in this country until last year (1933), when it was taken in some numbers in Staffordshire. I am indebted to Mr. W. E. China for the identification of this species.

Wednesday, 5th December, 1934.

Dr. S. A. Neave, O.B.E., President, in the Chair.

The Secretary read for the second time the nominations of the Council for Officers and Council for 1935.

Election of Fellows.

The following were elected Fellows of the Society :—Walter William Baum, Hazelhurst, 68, Hillmorton Road, Rugby; Andrew G. Hamilton, Imperial Institute of Entomology, British Museum (Natural History), Cromwell Road, S.W.7.

Obituary.

The death of Mr. G. C. Leman, elected a Fellow of the Society in 1920, and of Major H. C. Jeddere-Fisher, elected a Fellow in 1928, was announced.

Exhibits.

The following communications were made to the meeting :—

A new host record for *Phryxe vulgaris* Fall. By A. W. McKenny Hughes.

I have not traced a record of *Phryxe vulgaris* Fall., as a parasite of *Borkhausenia pseudospretella* Stn. and wish therefore to record it as having been bred from a larva of this common moth.

The first recorded capture of *Argynnis maia* (Cramer) in England. By E. B. Ford.

Mr. A. W. Bennett captured a specimen of *Argynnis maia* (*pandora*) between 3–9 August, 1911, near Tintagel, Cornwall, in a valley called St. Knighton's

Kieve. It was flying with several others over a large patch of purple loose-strife, and Mr. Bennett, realising that it differed from *A. paphia*, managed to secure it with his cap. He then pinched it, and set it with an ordinary pin on a flat piece of wood. On comparing the specimen with examples of the latter species in the British collection which he had formed many years previously, it was at once evident that it differed considerably from them.

Thinking that it was of some interest, Mr. Bennett sent the specimen to a well-known Entomologist who had published a work on British butterflies and moths several years previously. He supplied him with the details of its capture, and asked him if he would kindly give him some information about it. The gentleman in question did not see fit to reply to Mr. Bennett, but sent back the specimen, writing on the brown-paper wrapper the words, "*Argynnis paphia.*" On its return, one of its antennae was found to be missing.

A few years later I identified the insect from a book on European butterflies, but after his previous experience, Mr. Bennett did not feel inclined to go further with the matter. The specimen has remained in his cabinet since his death some years ago. It was shown to the meeting with a photograph, taken at the time, showing the spot where it was captured.

Habits of *Gonteosphodrus bicolor* Chees., a Reduviid from Papua. By L. Evelyn Cheesman.

The chief food of these bugs in the adult stage is bees and wasps, and they are usually found on plants or blossoms. Any vibration causes them to throw up the fore legs above the head, in which position they wait for victims : small insects are merely stabbed with the proboscis, but the fore-legs are used to strike down and hold on the ground larger bees and wasps. The thorax and legs have long, stiff hair, which is covered with a viscid fluid. From dissections of the legs made by Dr. Eltringham it is proved that there is a secreting hypoderm underneath the cuticle.

Tabanidae near Durazzo, Albania. By D. J. Lewis.

I wish to record the almost complete disappearance of Tabanid flies from the neighbourhood of the Durazzo Lagoon in Albania as a result of malaria control by measures against mosquitoes. The lagoon is a sheet of brackish water about four miles long, with extensive reed beds, and in July 1932 horse flies were abundant on the shore, biting men and cattle. Egg batches were numerous on the reeds. Only three species, *Tabanus solstitialis* Schin., *T. acuminatus* L., and *Chrysops italicus* Mg., were found although fourteen species were collected altogether in Albania. The lagoon was a breeding place of vast numbers of the malaria-carrying mosquito, *Anopheles elutus*, which have been controlled by the use of automatic tide gates which introduced sea water into the lagoon and raised its salinity. During a visit in July 1934 lasting four hours I noticed only one Tabanid in spite of the presence of cattle.

The Swarming Habits of some West African Diptera. By D. J. Lewis.

Note : The Milichiid fly whose swarming habits at Gadau, Nigeria, I described in 1934, *Proc. R. ent. Soc. Lond.*, **9** : 4, has been named *Pareccoptoma nigeriae*

Duda. The climatic conditions at Gadau at the time are described by Prof. P. A. Buxton and D. J. Lewis in 1934, *Phil. Trans. Roy. Soc.*, **224** : 175–240.

Assemblages of Coccinellid beetles ; also of the Danaid butterfly *Danaus plexippus* Linn., during hibernation or migration. By Prof. E. B. Poulton.

Miss F. J. Kirk's description * of *Coccinella bipunctata* L. assembling in her house, 52 Oakhill Road, Putney, referred to by Mr. H. Donisthorpe in our *Proceedings*, (**9** : 82), is a very interesting addition to the records of the behaviour of these beetles. Miss Kirk's ladybirds hibernated in a crevice in the ornamental plaster of the ceiling but in warmer weather left their retreat and flew about the room for hours at a time, striking the ceiling and always settling down in their old quarters. Miss Kirk has kindly informed me that all, or occasionally some, of the Coccinellids left the crevice in the evening, never in the daytime, and were back again in the morning. The fact that the deserted crevice should have been promptly regained suggests some definite stimulus—probably smell, because a small, roundish, discoloured patch marked the exact spot on which they clustered. This same resting-place was used in the following year but by very few of the beetles.

J. H. Fabre's account † of the seven-spotted ladybird assembling on Mont Ventoux suggests hibernation, but the gathering which he observed in June on the tableland of St. Armand can hardly have been for this purpose. He describes the effect of the sun's rays upon the legions of ladybirds gathered on the pedestal of a stone cross and the rocks forming its base. "They were mostly quite still, but wherever the sunbeams struck there was a continuous exchange of place between the newcomers, who wanted to find room, and those resting, who took wing only to return after a short flight." This summer assemblage which puzzled Fabre may probably be explained as an adaptation to promote cross-breeding, as suggested in our 1904 *Proceedings* (**1904** : xxii–xxvi) where many examples of Coccinellid and other gatherings are discussed.

My friend Dr. C. B. Williams has sent me the following interesting observations on the assembling of *D. plexippus*, the Monarch butterfly, described by Mr. L. McCormick-Goodhart, of Langley Park, Silver Spring, Maryland, in a letter to Capt. T. Dannreuther, R.N. :—

"1934, *Oct.* 19.—These butterflies were in enormous quantities on Nantucket Island where my family and I spent the summer and where the prevailing summer wind is a fairly strong westerly one. In the evenings we were fascinated by the way in which they roosted on the trees by the house. The butterflies would come in from every point of the compass and promptly join their comrades on a particular section of the foliage on the side of the tree away from the wind. The flight towards the trees took about half an hour in all." A little later in the letter the writer states that "about a hundred of these active Monarchs roost every night like starlings on the three forty-foot silver Maples by the house."

* 1924, *Ent. Record*, **36** : 9–10.
† "Insect Life," Engl. transl., Macmillan, Lond., 1901, pp. 202–204.

In these fascinating assemblages various possible interpretations are to be borne in mind :—

1. *Migration*, ensuring that the bands are not scattered and dissipated; also that both sexes are represented.

2. *Hibernation*, ensuring these same conditions during and at the end of the winter sleep.

3. *Promotion of cross-breeding*, due to the assemblage at one spot of insects scattered over a wide area.

4. *Enhancement of aposematic effect*, a result suggested, as regards protective odours, by Fritz Müller, in *Kosmos*, Dec. 1877, translated by Prof. R. Meldola in our 1878 *Proceedings*, **1878** : vi, vii.

It is obvious that two or more of these advantages of the gregarious habit are generally combined. Indeed the last-named would appear to be nearly always present.

Warning Colours and Mimicry : a Reply to Dr. McAtee.

By Hugh B. Cott, M.A., F.R.P.S., F.Z.S.

(*From the Department of Zoology, Glasgow University.*)

With Plates I–IV.

[Communicated, in the absence of the author, by Prof. Poulton, who referred to the unfairness of Dr. McAtee's criticisms, and, after reading Belt's account of the Nicaraguan frog from the rare original edition (1874), presented to the Society by the late Mrs. Meldola, recalled Darwin's opinion of the work—" It appears to me the best of all natural history journals which have ever been published."]

In the *Quarterly Review of Biology* for June, 1933 (9), there appears from the pen of Dr. McAtee a somewhat aggressive notice of my paper " On the Ecology of Tree-Frogs in the Lower Zambesi Valley, with special reference to Predatory Habits considered in relation to the Theory of Warning Colours and Mimicry " (4). Besides much that is either frivolous or irrelevant, the review is compounded so largely of misstatement and misrepresentation, that I feel bound to reply to this attack by drawing attention to some of the fallacies and extravagant assertions which it contains.

The greater part of the review consists of a criticism of one of the introductory sections in my paper, in which I discussed the appearance, habits and habitat of some East African tree-frogs and made certain tentative suggestions relating to the adaptive significance of colour in the Anura. I hope Dr. McAtee will forgive me for saying that if he had observed these tree-frogs, as I have done, in their natural surroundings in the palm forests of the Lower Zambesi, the greater part of what he says under this head would not have needed to be written.

Dr. McAtee writes at considerable length upon *Megalixalus fornasinii*, a small tree-frog wearing a bold disruptive pattern which I suggested—on the evidence of the frog's appearance in the field and of its food-habits as shown by stomach-contents —operates as an aggressive colour-scheme, enabling it to ambush active prey (Acridiidae, Odonata, Muscidae and Lepidoptera), which groups were eaten in conspicuously greater numbers by *M. fornasinii* than by any other species examined

(p. 476, Table II). We will now consider, as briefly as possible, what Dr. McAtee's criticism in this connection is worth.

On the general question of the appearance of *M. fornasinii*, his argument is irrelevant. "What matter," he asks, "to its victims whether it is frog-like or unfrog-like? It is one of the things that gets them and if they react defensively at all, it would be in relation to what the frog is—an enemy—without regard to kind." Dr. McAtee is apparently either unable or unwilling to appreciate the function of a disruptive colour scheme, which may—as every field naturalist knows—be most effective in rendering more difficult the recognition of an animal by enemies or by prey. It is easy for Dr. McAtee to deny the effectiveness of this type of camouflage; but the experience of the Great War proved that it was neither easy nor expedient to dispense with precisely this principle, which was applied in the so-called "dazzle" painting of ships with conspicuous success as a means of defence against submarine attack.

Passing from general to particular aspects of the question Dr. McAtee proceeds to criticise my observations on the stomach-contents of this frog. Referring to the ACRIDIIDAE he tells us: "The statement that they are eaten in conspicuously greater numbers by this frog than by any of the other species examined is untrue, as 7 ACRIDIIDAE were found in 360 stomachs of *Megalixalus*, or 1 to each 51·4 stomachs, while 3 were found in 122 stomachs of another frog (*Hyperolius argus*), or 1 to each 40·6 stomachs." It is often useful to read a document before stating what is contained in it. If Dr. McAtee will turn to the page concerned (p. 486) he will see that he has misstated the facts, and that 4 ACRIDIIDAE were found in 254 stomachs of *H. argus*, or 1 to each 63·5 stomachs; and, incidentally, that the only other species (*H. bayoni*) to contain *any* of these insects had a single example in 110 stomachs—a point which he conveniently omits to mention.

Dr. McAtee continues: "The Lepidoptera found in the stomachs of this frog were more than half larvae or caterpillars, mere 'worms' to which the terms 'active, alert, rapid in flight' most assuredly do not apply." This remark misrepresents the facts. The figures to which Dr. McAtee refers and to which I referred (Table II)—namely 26 Lepidoptera from 360 *M. fornasinii* as compared with 11 from 438 other tree-frogs—do not, of course, include larvae. They relate to adult insects only. But had Dr. McAtee been in any doubt upon this point, he could have verified the matter by turning to Table IV where the food-animals are classified, and where separate figures are given for caterpillars and adult insects.

We then read the following criticism: "Cott, while dilating on the powers of *Megalixalus* in capturing prey 'active, alert, rapid in flight,' says nothing about the much greater prevalence in the food of this frog of the feeble and partly wingless plant lice." Now this statement is, so far as I can see, quite irrelevant. It also happens to be quite untrue. I never said, or implied by what I said, that *Megalixalus* eats no food other than that which was active, etc. But I did point out (p. 503) in reference to plant lice eaten by this species that "they appear to be rarely used as food, for only eight out of 245 frogs [with recognisable stomach-contents] had eaten them, the stomachs of two frogs containing more than half the total number."

With reference to the next curious remark, which follows immediately after the above, that I have nothing to say as to why this frog fed to a considerably smaller

extent upon ants than did any of the other species—is it possible that Dr. McAtee has failed to realise that if the frog's food is made up of a larger percentage of large insects, *e.g.* ACRIDIIDAE, MUSCIDAE, etc., than that of the other frogs examined, it must eat a lower percentage of smaller insects, *e.g.* ants, which make up the main food (93–98 per cent.) of the other frogs?

Dr. McAtee next turns his attention to the question of warning colours, and we have further examples of the misleading statements, error, and prejudice with which he expresses his unfathomable antagonism to everything not in accord with his own views. In reference to *Hyperolius argus*, the females of which have a striking and distinctive colour pattern—being purplish or chocolate-brown, with large conspicuous orange black-bordered ocelli on the back and a canthal stripe of the same colour—I made the tentative suggestion that this colour-scheme may have an aposematic function. What I said was: "Were there any evidence (and at present I know of none) to show that the females are 'protected' by a poisonous secretion, then this would be cited as a good example of warning coloration. The conspicuous colour-scheme and the habit of exhibiting this to the best advantage in exposed situations certainly suggests something of the kind" (p. 478). My reviewer takes exception to this suggestion, and in doing so he attempts to improve on it with a somewhat comical suggestion of his own. He has evidently never seen the frogs upon whose appearance he speculates, for he speaks of the "eye-spots" as "almost matching some of the holes on a leaf on which it sits." If holes in leaves are circular, coloured bright orange and edged with a black margin, then I would agree with him, but holes of this description are outside my own experience.

The adaptive significance of colour, about which a good deal is known in relation to insects, has been little studied in relation to the Anura. The question is one which for reasons of space could not be considered in the paper under review, beyond reference in a general way (p. 478) to certain classes of coloration, namely procryptic coloration, special protective resemblance, flash colours, and warning colours associated with poisonous secretions, and to the habits of birds and snakes, the chief enemies of the group. In conclusion I said: "Faced as we are at present with scanty data, it is impossible to reach definite conclusions. The facts at our disposal do, however, appear to indicate clearly that we have in these batrachians phenomena which closely parallel many of those relating to procryptic and aposematic colouring in insects. It would be a study of the greatest interest to determine, by observation in the field and by experiment, to what extent the various features of adaptive coloration in the latter group find their analogy here." In order to show the close resemblance between the adaptive coloration of batrachians and insects, photographs of the former, taken during life and in entirely natural surroundings, are reproduced on plates I–IV. Procryptic resemblances to grasses and tangled vegetation (I), to leaves (II), to bark (III, fig. 1; IV, fig. 1), recall the protective colours and patterns of insects living in similar environments, while the aposematic display (III, fig. 2; IV, fig. 2) is brought about by the same bright colours and sharp contrasts with which we are familiar in insects. It will also be observed that the photographs were taken in different parts of the world.

I wish to emphasise that it is essentially only when different animals—whether frogs or insects or others—are studied in their natural surroundings that it is

possible to appreciate the significance of form, colour and pattern, and then only in the *living* creature, when these can be considered in relation to particular postures and habits, and to the habits of potential prey and enemies. As regards frogs, observations in this field are greatly needed. It must be remembered that birds and snakes, the chief enemies of frogs, hunt largely by sight. The following vivid account by Ditmars (5), which I quote in full, illustrates the important place occupied by vision in the hunting of prey by *Eutenia saurita* :—" The writer witnessed an example feeding in a belt of swampy timber. The high rasping croak of a small frog, directed his attention to the ribbon snake, about two and one-half feet long, which had grasped the frog by a hind leg. So vigorous were the frog's efforts, that it tore itself from the snake's grasp and started away in a series of rapid hops, with the reptile in pursuit. The serpent's movements were amazingly quick, and its power of vision in following the movements of the frog apparently acute. It darted after the amphibian for a distance of possibly eight feet, when the frog stopped, having secreted itself among some leaves. The snake also paused, but was all attention, with neck upraised and constantly darting tongue. It prowled about in frenzied fashion, when a movement of the frog attracted its attention, and it was instantly upon it, this time retaining its hold until the prey was swallowed." This incident is of particular interest because it illustrates the vital importance of *stillness*, without which the best obliterative coloration can be of no avail.

Dr. McAtee, as we should expect, disagrees with the analogy between adaptive coloration in frogs and insects respectively, to which I have drawn attention. He describes my attitude as " a very good one-page record of assumption, misstatement, and error even for a selectionist." The passages to which he refers in these terms are discussed below. But what interests me here is not so much his opinion of my work as his method of attacking it—which is to ignore the evidence, and then to deny that it exists. Thus, referring to the adaptive significance of colour in frogs, his first criticism is that " self-persuasion in the lack of evidence is something entirely out of place in science." Now there is no lack of evidence—even on the page to which he refers; Dr. McAtee might do well to consider whether there is a place in science for self-persuasion in spite of evidence.

His second criticism here is against my remark, " Poisonous skin-secretions are of common occurrence among the Anura. In many species they are known to furnish an effective means of defence against predatory enemies." " If the word *many* is taken at its ordinary valuation, this," he says, " is a definitely untrue statement " (p. 211). As this point is closely related to the next, I shall deal with both together below. Finally, referring to my remark that " Snakes and birds, the principal enemies of frogs, depend largely upon vision in hunting prey. There is evidence that these enemies learn to discriminate between poisonous forms and those which are good to eat," he reverts to his earlier contention that " there is no evidence of any frog being dangerously poisonous either to snake or bird predators upon it, hence the discrimination alleged is a myth." In view of the above dogmatic denials and assertions, it will be appropriate to direct attention to observations which bear directly upon these two questions.

One of the earliest observations on the efficiency of poisonous secretions in the Anura is that by Belt, the naturalist and explorer, who gives the following account of certain Nicaraguan frogs (2) :—"In the woods around Santo Domingo there are

many frogs. Some are green or brown, and imitate green or dead leaves, and live amongst foliage. Others are dirty earth-coloured, and hide in holes and under logs. All these come out only at night to feed, and they are all preyed upon by snakes and birds. In contrast with these obscurely coloured species, another little frog hops about in the day-time dressed in a bright livery of red and blue. He cannot be mistaken for any other, and his flaming vest and blue stockings show that he does not court concealment. He is very abundant in the damp woods, and I was convinced he was uneatable so soon as I made his acquaintance and saw the happy sense of security with which he hopped about. I took a few specimens home with me, and tried my fowls and ducks with them; but none would touch them. At last, by throwing down pieces of meat, for which there was a great competition amongst them, I managed to entice a young duck into snatching up one of the little frogs. Instead of swallowing it, however, it instantly threw it out of its mouth, and went about jerking its head as if trying to throw off some unpleasant taste."

Of *Bombinator igneus* Gadow says (7) : " When these toads are surprised on land, or roughly touched, they assume a most peculiar attitude. . . . In reality this is an exhibition of warning colours, to show the enemy what a dangerous animal he would have to deal with. The secretion of the skin is very poisonous, and the fire-toads are thereby well protected. I know of no creature which will eat or even harm them. I have kept numbers in a large vivarium, together with various snakes, water-tortoises, and crocodiles, but for years the little fire-bellies remained unmolested, although they shared a pond in which no other frog or newt could live without being eaten. Hungry water-tortoises stalk them under water, touch the intended prey with the nose in order to get the right scent, and then withdraw from the *Bombinator*. . . . "

The same authority tells us that the " strongly poisonous secretion " of *Dendrobates tinctorius* is said to be employed by the Indians of Columbia for poisoning their arrows, the poison acting on the central nervous system and being used especially for shooting monkeys (7).

Ditmars, whose wide experience as a field naturalist and as Curator of Reptiles in the New York Zoological Park enables him to speak with authority, says of the feeding-habits of the Black Snake (*Zamensis*) : " Frogs are also eaten, but among these are several species that the snake will grasp and immediately reject. An example of this type of batrachian is *Rana palustris*, which exudes an irritating secretion from the skin. Toads are never eaten. . . . " (5).

The poison of *Rana palustris*, the common Pickerel Frog, is also referred to by Wright, who states that it will frequently kill other species of frogs carried home in the same jar with it (12).

The effectiveness of the poison of toads is mentioned by Gadow, who says : " The milky secretion of toads protects them against many enemies, although not always against the grass-snake. A dog which has once been induced to bite a toad, suffers so severely that it will not easily repeat the experiment " (7).

Referring to the East African toad *Nectophrynoides viripara*, Loveridge (8) states that " When killed in chloroform the large glands on the back and limbs exude a considerable quantity of poison which is as fluid as cow's milk."

Bufo marinus, the giant toad of the Amazon, is rendered formidable and well-nigh immune from predatory attack by the virulent poison of the highly developed

parotid glands. The fatal effect of the poison on would-be predators was brought to my notice all too plainly in the case of a fox terrier belonging to the Rev. A. Miles Moss, of Pará, when it inadvertently bit one of these toads and died within a few hours as a result of the poison discharged into its mouth. Of this species Noble writes that it "produces one of the most virulent poisons known among the Amphibia, one that frequently kills dogs which have not learned to leave the toad alone" (10).

Hyla venulosa, the Brazilian "flying" frog, produces, on being handled or irritated, a copious flow of whitish secretion—sticky and acrid, which cannot fail to act as a deterrent to many potential predators.

Of a related species Barbour writes as follows: "*Hyla vasta*, of Santo Domingo, has a skin poison so strong that it burns one's hands painfully when the frog is handled" (1).

Noble says of the African *Phrynomantis bifasciata*, that it also has "been found under certain circumstances temporarily to inflame the hands of the collector" (10), and that both this and the previous species produce great quantities of milky secretion.

In a recent publication Loveridge (8) also refers to the skin secretions of the gaudy and sluggish *P. bifasciata* as follows:—"I have previously drawn attention to the poisonous nature of the secretions of this frog, a further example came to my notice at Mwaya. One of my boys brought me a bag containing a mixed catch of frogs from bananas—*Hyperolius*, *Megalixalus*, *Leptopelis* and half-a-dozen *Phrynomerus* [*Phrynomantis*]. I chloroformed the whole lot in the bag. An hour later I tipped the catch out on to a table and began picking out the various species. The *Phrynomerus* had exuded a considerable amount of intensely sticky dermal secretion which had gummed the smaller *Megalixalus* together. After separating these and dropping them into water I could not get the gummy mucus off my fingers by washing and so rubbed them in the dust —as a monkey would do—then by rubbing them together shed the mucus like so much gutta-percha. Shortly afterwards irritation set in on my finger-tips, entirely comparable to the irritation produced by stinging nettles and it actually appeared to spread *within* my arm up to the elbow of the right arm. . . ."

It may be noted here that where very conspicuous colours occur in the group, they are characteristically associated with an effective means of defence, though the converse is by no means true, for other forms, such as *Hyla*, *Bufo*, *Ceratophrys*, may combine poison with cryptic coloration and habits. On the question of warning colours Gadow writes (7): "Most, if not all, Amphibia are more or less poisonous, and it is significant that many of the most poisonous, e.g. *Salamandra maculosa*, *Bombinator*, *Dendrobates*, exhibit that very conspicuous combination of yellow or orange upon a dark ground, which is so widespread a sign of poison." Further striking examples of this relationship between aposematic colour and effective poison in frogs are furnished by the red and blue frog described by Belt, by the observations (quoted below) of Budgett and Professor Graham Kerr in the case of *Phryniscus* and *Phyllomedusa*, and by the pink or vermilion, and black *Phrynomantis bifasciata*.

The foregoing observations prove the effectiveness of skin-secretions in defending certain Anura against predatory attack. I shall now recall some further observa-

tions, which besides providing additional evidence upon this point, are especially significant in relation to discrimination by predators.

The following valuable observations by Ditmars (5) throw light upon this question, and I quote in full his account of an experiment in New York Zoological Park to test the powers of discrimination in the King Cobra (*Naia bungarus*). " To test the assertion that *N. bungarus* feeds but seldom upon the Viperine snakes, possibly possessing an instinctive dread of the deep wounds liable to be inflicted by the fangs of such reptiles, the following experiment was conducted.

" A large, thick-bodied, harmless water snake (*Tropidonotus taxispilotus*), and a poisonous water moccasin (*Ancistrodon piscivorus*), of much the same proportions, were selected for the experiment during a period when the big cobra was voraciously awaiting its weekly meal of a living snake. The door of the cage was rolled back, and the poisonous snake thrown inside. The cobra made the customary rush for the food, but upon reaching the snake paused abruptly.

" This was the first time in the feeding of this king cobra in our Reptile House that he failed immediately to seize his victim and begin to swallow it. The moccasin was permitted to remain in the cage for about five minutes, during which time the cobra reared slightly from the door, and regarded it intently. To ascertain whether the cobra was hungry, a common striped snake was placed in the cage. It was grasped and swallowed without hesitation.

" The moccasin was again introduced. There was the same rush, and the same careful examination of the newcomer. This time, annoyed by the unceremonious treatment it had received, the pit-viper showed fight. Upon this display of hostility the cobra backed off hurriedly, nervously dilating its hood, and rearing upward. The moccasin was finally removed unharmed, and the large, harmless water snake was quietly placed in the cage. To the human observer it matched the moccasin closely, and made a show of temper considerably more emphatic than the former, but the cobra attacked it without an instant's hesitation and soon swallowed it. This experiment was repeated, and always with the same result. The cobra appeared to instantly distinguish the dangerous character of the poisonous snake."

Discrimination, in spite of Dr. McAtee's assertion, is no myth. That preference in the choice of food is usual with the majority of snakes is evident from Ditmars' account of the feeding-habits of *Spilotes* (5): " The species of *Spilotes* are particularly interesting in their feeding habits, as they are quite omni-carnivorous—feeding upon lizards and snakes, all types of batrachians, including the toads, *which lack of preference in the selection of prey among creatures that greatly vary in a possession of highly irritating skin secretions, is quite unusual for serpents that also prey as often as occasion permits, upon mammals and birds* " [italics mine].

The boomslang (*Dispholidus typus*) hunts for frogs in addition to its more favourite food of chamaeleons, birds, and their eggs; but it will not eat toads (6).

Budgett (3) mentions the food preferences of a grass snake, which was able to discriminate between palatable and unpalatable batrachians. A frog, *Paludicola signifera*, was put into a cage " in which were many brightly coloured frogs, including *Phryniscus nigricans* and *Phyllomedusa hypochondrialis*. In this cage was also a small grass snake. Hitherto it had taken no interest at all in the gaudy frogs in its cage; but as soon as the little *Paludicola* made its first spring, it was caught in mid air by the snake." It may be added here that the colour of *Phryniscus*

nigricans and *Phyllomedusa hypochondrialis* is in each case typically aposematic, that of the former species being black with yellow spots above, and black and scarlet beneath, while in the latter the back is green or blue, and the flanks scarlet with transverse bars of black.

Some of the earlier quoted observations relating to poisonous secretions as a means of defence may also be recalled here as further evidence of discrimination by snakes and other reptiles, *e.g.* Gadow on the immunity of the fire-bellied toad, and Ditmars on the food-habits of *Zamensis*, and by birds, *e.g.* Belt's aposematic frogs refused by fowls and ducks.

In conclusion, I may mention another clear case of discrimination for the particulars of which I am indebted to Professor Graham Kerr. This relates to a Seriema (*Cariama cristata*) which was kept as a pet in the Paraguayan Chaco. The bird, though tame, had complete liberty, and being very fond of frogs, it was accustomed to follow its owner, anticipating the amphibian tit-bits which were to be discovered beneath the logs and stones that were overturned for the bird's inspection. But the Seriema was under no misapprehension as to the unpalatability of the black and yellow and scarlet *Phryniscus nigricans*. One look was enough : it could never be induced to have anything to do with this species, which, says Budgett, " at ordinary times is the slowest and most bold of frogs." Charles Darwin also writes * of this species which he observed when visiting Bahia Blanca in 1833 :—" Amongst the Batrachian reptiles, I found only one little toad (*Phryniscus nigricans*), which was most singular from its colour. If we imagine, first, that it had been steeped in the blackest ink, and then, when dry, allowed to crawl over a board, freshly painted with the brightest vermilion, so as to colour the soles of its feet and parts of its stomach, a good idea of its appearance will be gained. If it had been an unnamed species, surely it ought to have been called *Diabolicus*, for it is a fit toad to preach in the ear of Eve. Instead of being nocturnal in its habits, as other toads are, and living in damp obscure recesses, it crawls during the heat of the day about the dry sand-hillocks and arid plains. . . ."

The above observations by the herpetologists and field naturalists best qualified to speak on these matters provide a valuable and illuminating contrast to Dr. McAtee's *ex cathedra* pronouncements upon the general inefficiency of the defensive secretions of the Anura, his special pleading that there is lack of evidence for the adaptive significance of colour in frogs, and his confident assertion that discrimination by birds and snakes is a myth !

Dr. McAtee next turns his attention to the adaptations of insects. Commenting upon Swynnerton's experiments (11) which I quoted (pp. 493–4), he once more restates his views on the indiscriminacy of predators, endeavouring to explain away the reluctance of insectivorous animals to eat protected insects as due, not to preference, but to satiety. He says : " A man can eat beefsteak until it palls upon him, but still have an appetite for pastry, and perhaps even for icecream and candy after that. The reverse, however, is just as true, for, granted a fresh start, after being cloyed with candy, he can again relish beefsteak." Now this is all very entertaining, but what does it prove ? Does Dr. McAtee believe that a choice of food that is due to satiety disproves the existence of a choice of food that is due to preference ? But apart from the bad logic of his argument, the analogy is false,

* *A Naturalist's Voyage*, 1897. London. Chap. V, p. 91.

in that the comestibles which he mentions are all more or less palatable, whereas the insects under consideration are believed by everyone except Dr. McAtee to be relatively unpalatable.

" The whole of the experimental evidence as to edibility of prey," Dr. McAtee tells us, " is scarcely worth the paper it is printed upon, a fact pointed out by McAtee twenty years ago." This is not a fact, but an expression of opinion; and twenty years ago the greater part of the experimental evidence as to edibility was not on paper : nevertheless his statement is not without value, for it enables those who are familiar with the experimental evidence to judge how far they may allow weight to Dr. McAtee's opinion. But I am not quite clear what bearing these pronouncements have upon my paper under review, unless they are intended to distract the readers' attention from the fact that my observations were based not upon experiments, but upon the evidence of stomach-contents of wild animals—a type of evidence which is not open to any of the objections which he raises here. Limitations of space prevent me from referring to more than a few of the remaining fallacies on the same page, where Dr. McAtee's well-known conclusions on availability are given a flourish :—" Animals take what is most available at the particular time and place . . . feeding proceeds from the more to the less available items, not from imaginary preferred or palatable, to the less preferred or unpalatable things. No one who has studied the food habits of wild animals can doubt that availability is in general the controlling factor in the choice of food. . . . There is practically no such distinction as insects good, and not good to eat, for the evidence indicates that all are eaten more or less in proportion to their numbers."

Now what is the evidence ? It is typical of Dr. McAtee's methods of criticism that in the course of an extensive review of my paper he makes no mention whatever of the main body of evidence which it contains ! In the principal section I dealt with the usefulness of various adaptations in protecting insects against predatory attack by batrachian enemies, as indicated by the stomach contents of 794 tree-frogs. This material was classified in order to show what light the feeding habits of these animals throw upon the relation which is supposed to exist between colour and edibility in insects. Of 10,968 specimens sufficiently complete for analysis, only 14 specimens (·13 per cent.) belonged to the typically aposematic colour group. Not only does he completely ignore these and other facts in my paper which strongly support the theory of warning colours, but Dr. McAtee improves upon the occasion by referring to the evidence here as indicating " practical indiscriminacy."

If Dr. McAtee chooses to turn his back upon all the facts which support the theory of warning coloration, that is his own affair. But his methods of dealing with the evidence demand some comment from those whom he would criticise. Here, as we have seen, his methods are to ignore the facts, to misstate the facts, and to misrepresent the views of those who interpret the facts. As though this were not enough, he further confuses the issue with the introduction of irrelevant matter, with abuse of those with whom he disagrees, and with extravagant speculations upon what their religious views might have been had they lived before the days of Darwin !

The little personal thrusts in his present attack can interest no one except myself. For the rest, the dust of error and misunderstanding which he has stirred up will settle; and with the return of better visibility I cannot do better than commend

Dr. McAtee's review, as to fairness, logic and taste, to the judgment of those whom it may interest.

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Explanation of the Plates.

Plate I.

Rana temporaria Linn. Photograph of the common frog in its natural surroundings, illustrating the combined effect of concealing coloration, obliterative shading and a disruptive pattern, in rendering the animal inconspicuous. From life. Battle, Sussex. Approximately $\frac{1}{2}$ life size.

Plate II.

Bufo typhonius Linn. A leaf-like South American toad which approaches in its form, colour and marking the special protective resemblance to leaves seen in various butterflies, moths, grasshoppers and leaf-insects. From life. Pará, Amazon. Approximately $\frac{2}{3}$ life size.

Plate III.

Fig. i.

A South American tree-frog, showing the procryptic resemblance to bark. From life. Pará, Amazon. The specimen—the only one of its kind that was seen—escaped while being photographed.

Fig. ii.

Hyperolius marmoratus Rapp. A very conspicuous East African Polypedatid tree-frog, wearing a pyjama-like pattern of light-yellow orange-centred stripes alternating with bands of black. From life. Charre, Portuguese East Africa. Approximately $1\frac{2}{3}$ life size.

Rana temporaria **Linn. Battle, Sussex.**

Hugh T. Gilt, Photo.

Bufo typhonius **Linn. Pará.**

Hugh B. Cott., Photo.

Hugh B. Cott, Photo.

Unidentified Tree Frog. Lower Amazon.

Hugh B. Cott, Photo.

Hyperolius marmoratus **Rapp. Portuguese East Africa.**

Hugh B. Cott. Photo.

Chiromantis xerampelina **Peters. Lower Zambesi.**

Phrynomantis bifasciata **Smith. Lower Zambesi.**

Plate IV.

Fig. i.

Chiromantis xerampelina Peters. An East African Polypedatid tree frog, showing procryptic resemblance to bark. From life. Charre, Portuguese East Africa. Approximately $\frac{2}{3}$ life size.

Fig. ii.

Phrynomantis bifasciata Smith. A sluggish aposematic East African Brevicipitid frog, wearing a livery of vermilion and black. From life. Caia, Lower Zambesi. Approximately life size.

Termination of the Controversy with Dr. W. L. McAtee. By Prof. E. B. Poulton.

In a recent paper to which the Registrar directed my attention—"Does 'Protective Coloration' protect—results of some experiments with fishes and birds,"* the author, F. B. Sumner, writes of "the interminable controversy regarding the protective value of animal coloration" (p. 559). Indeed, I fear that to many of our Fellows the discussion must appear well-nigh interminable and that they will welcome its conclusion as heartily as I do. Nevertheless I do not plead guilty to starting it or to entering into it hurriedly. Nearly twenty years passed before I wrote, referring to Dr. W. L. McAtee's first attack,† "I was probably mistaken in not at once writing a detailed reply to these criticisms, which were not only directed against the conclusions drawn from experimental feeding, but also against other conclusions on which the theory of mimicry is founded." ‡ The necessary limits imposed upon an address prevented more than a brief statement on that occasion, but in the following year McAtee renewed his attack, in a paper entitled "Effectiveness in Nature of the So-called Protective Adaptations in the Animal Kingdom, chiefly as illustrated by the Food Habits of Nearctic Birds." § To this and his earlier publication, I replied in a paper, read July 1932—"Attempts to disprove the Theories of Warning Colours, Mimicry and Protective Resemblance in Insects." ‖ Dr. F. Morton Jones' important paper, "Insect Coloration and the Relative Acceptability of Insects to Birds," ¶ recording his valuable and careful experiments, was read on 1 June and published in December, 1932, the month during which a discussion on "Protective Adaptations of Animals—especially Insects" was held before our Society (1932 (1933), *Proc. ent. Soc. Lond.*, **7** : 79–105). To this discussion and Dr. Morton Jones' paper, a rejoinder was published by Dr. McAtee in 1933, *Proc. R. ent. Soc. Lond.*, **8** : 113–126, and answered in 1934, *Ibid.*, **9** : 21–40. To these published papers, replies and rejoinders must be added Dr. McAtee's

* 1934, *Proc. nat. Acad. Sci.*, (10) **20** : 559–564. To give an adequate account of this excellent paper would occupy too much space and I must content myself with the author's conclusion from his experiments :—"*It seems evident, in view of all these facts, that fishes which harmonize in shade with their immediate surroundings are less likely to be eaten by birds (or at least by certain birds) than fishes of the same species which do not so harmonize.*" (Author's italics, p. 564.)

† *Proc. Acad. nat. Sci. Philadelphia*, **1912** : 281–364.

‡ "A Hundred Years of Evolution," the Presidential Address to Section D—Zoology, at the Centenary Meeting of the British Association, London, 1931 (*Rep. Brit. Assoc.*, **1931** : 90).

§ 1932, *Smithson. Misc. Coll.*, **85** (No. 7) : 1–201.

‖ 1932 (1933), *Proc. V. Congr. internat. Ent., Paris* : 33–44.

¶ 1932, *Trans. ent. Soc. Lond.*, **80** : 345. The evidence here brought forward is further strengthened by Dr. F. M. Jones' paper, "Further experiments on coloration and relative acceptability of insects to birds," 1934, *Trans. R. ent. Soc. Lond.*, **82** : 443–453, 2 pls.

criticisms answered by Mr. Cott on pp. 109–119, together with the correspondence in *Nature* during 1932.

I have not taken part in this discussion with the slightest hope of convincing Dr. McAtee but in order to guard the reader against accepting his confident assertions and from being misled by his controversial methods. This, I believe, has been sufficiently accomplished and I do not propose to continue the discussion with him, a decision which has been confirmed by the opinion of my friend Dr. F. Morton Jones, who wrote on 29 Sept. 1934 :—

" I think you are right that continued controversy which leaves the participants still of the same opinion and which takes up so much time and space, is unprofitable. Certainly the accumulation of evidence from every possible viewpoint, will have more permanent value. Obviously, we have not passed that stage yet, in the study of the significance of insect habit, structure, and coloration."

Apart from the discussion here referred to, Dr. McAtee's disparaging references to " Selectionists " suggest that he belongs to the Neo-Lamarckian school, powerfully represented in America half a century ago. I recall many keen but pleasant encounters with American comrades, and especially with my dear friend Prof. Fairfield Osborn at the 1888 meeting of the British Association in Bath, when we argued so far into the hours which should have been devoted to sleep that we found ourselves seriously debating how far an absolutely sterile hybrid could transmit qualities to its descendants ! However, the teachings of Weismann did not take long to soak in, and when Mendelian heredity was rediscovered Lamarckism received another tremendous blow. Although this great rediscovery was at first hailed as the end of Darwinian evolution by Natural Selection, further researches, chiefly by American zoologists, led to very different conclusions, as Prof. H. S. Jennings stated in 1917 :—" Evolution, according to the typical Darwinian scheme, through the occurrence of many small variations and their guidance by natural selection, is perfectly consistent with what experimental and palaeontological studies show us " ; appearing indeed to the author to be " more consistent with the data than . . . any other theory." *

The termination of this controversy does not by any means imply, as Dr. Morton Jones has pointed out above, any cessation in " the accumulation of evidence from every possible viewpoint . . . in the study of the significance of insect habit, structure, and coloration." In order to realise the fundamental importance of this evidence we only need to recall H. W. Bates' words on p. 511 of his classical paper † :— " The process by which a mimetic analogy is brought about in nature is a problem which involves that of all species and all adaptations."

* See *Proc. ent. Soc. Lond.*, **1917** : lxxxv, for amplification and references; also *Rep. Brit. Assoc.*, **1931** : 76, 77, reprinted as No. 2 in 1933, *Hope Reports*, **19**. See also S. E. [C.] Harland, on " The Genetic Conception of the Species," in *C. R. Acad. Sci. U.S.S.R.*, **1933** : 181–186.

† 1862, *Trans. linn. Soc.* (*Zool.*), **23** : 495.

ANNUAL MEETING.

Wednesday, 16th January, 1935.

Dr. S. A. Neave, O.B.E., President, in the Chair.

In opening the meeting the President said,

" Our Bye-laws lay down somewhat precise rules respecting the agenda at our Annual Meeting, which normally begins with the reading of the Council's report, but even these rules must, I think, be modified under exceptional circumstances. I feel sure that you will all agree with me that an exceptional, not to say unique, circumstance has arisen when the Honorary Life President of this Society receives a high honour at the hands of His Majesty the King, our Patron. It is indeed a happy chance for me personally to be occupying this chair on this occasion and to have the honour of moving a vote conveying the heartiest congratulations of the Society to Sir Edward Poulton and expressing the hope that he and Lady Poulton will long live to enjoy this recognition of his great services to our science."

This vote of congratulation having been put to the meeting was passed with acclamation.

Sir Edward Poulton briefly replied.

Mr. A. W. McKenny-Hughes, Secretary, read the names of Fellows nominated as Officers and Council for the ensuing year, and announced that they had been duly elected in accordance with the Bye-Laws.

He then read the following :—

Report of the Council, 1934.

In the first year of the Society's second century of life, it is with pleasure that the Council is able to report satisfactory progress in its various activities.

As was reported last year, the Council set up a Committee on Generic Nomenclature and agreed, on the Committee's recommendation, to publish in parts a work entitled " The Generic Names of British Insects." On 23rd February Parts 1 and 2 of this work were published; they contain the " Recommendations relating to the publication of the Committee's Reports," and " The generic names of the British Rhopalocera with a check list of the species," by Mr. Francis Hemming. Copies of these parts have been sent to all Fellows free. In accordance with the recommendations contained in Part 2, the Council have invited the International Commission on Zoological Nomenclature to take into immediate consideration the case for the suspension of the rules in respect of certain well-known generic names shown to be invalid under a strict interpretation of the rules.

In addition the Council have issued a Label List of the British Butterflies, which is one sale at 9*d*. per copy.

On 13th September a conversazione was given in the Society's rooms to enable Fellows to meet the delegates to the Third International Locust Conference, then being held in London under Government auspices. Exhibits were on view in the

Library and Meeting Room. The Council is indebted to Mr. C. L. Collenette for his assistance in this matter.

Since the last Annual Meeting one Special Life Fellow, the Rev. W. F. Johnson, and the following 11 (5) Fellows have died, or their deaths have been ascertained (the numbers in brackets in this and the following paragraphs indicate the corresponding figures for the previous year) :—J. B. Hicks, C. B. Holman-Hunt, Major H. C. Jeddere-Fisher, R. Kelly, S. T. Klein, G. C. Leman, W. Mansfield-Aders, A. H. Martineau, H. F. Newey, G. B. Routledge and M. L. Thompson.

The following 5 (6) Fellows have resigned :—J. H. Bell, A. Dicksee, W. Greenwood, R. H. T. P. Harris and M. C. McLeod.

The following 5 (6) have been removed from the List of Fellows in accordance with the Bye-Laws, Chapter XVI, Section 3 :—S. Madwar, F. Moysey, P. W. A. Scott, Mrs. H. S. Walsh and F. E. Wilson.

During the year 31 Ordinary Fellows have been elected. This more than compensates for the losses during the year, and the total result is again an increase in the number of Fellows. The Society now consists of 12 Honorary Fellows, 6 Special Life Fellows and 683 Ordinary Fellows, a total of 701.

The meetings have again been well attended, the average number of Fellows and Visitors at each being 60, a decrease of 24 on the previous year, which, however, was considerably above the normal owing to the high attendance at the celebration of the Society's Centenary.

The two parts of the *Transactions* for 1934 (Volume LXXXII) were published on 30th June and 29th December respectively. They comprise 20 papers by 19 authors. Of these, 7 deal with Hymenoptera, 5 with Diptera, 3 with Hemiptera, 2 with Trichoptera, 1 with Lepidoptera, 1 with Insect Teratology and 1 with the relation of insects to the food of birds.

The volume consists of 486 pages, and is illustrated by 17 plates, and thus is well up to the average. Financial assistance has again been forthcoming from various sources. The Royal Society authorised a grant of £75 from the Government Publication Fund towards Dr. Richards' paper, Dr. Cockayne paid the cost of the three plates illustrating his paper, Sir Edward Poulton and Dr. F. Morton Jones together paid the cost of the two plates illustrating the latter's paper, and the Zoological Laboratory, Cambridge University, paid half the cost of the figures illustrating Dr. W. H. Thorpe's paper.

The volume of *Proceedings* will consist of about 140 pages, illustrated by 4 plates, the cost of the plates being defrayed by a grant from the Carnegie Trustees.

The third volume of *Stylops* consists of 282 pages and is illustrated by 5 plates and numerous text-figures. It comprises 60 papers by 45 authors. Of these, 15 deal with Coleoptera, 12 with Diptera, 8 with Hymenoptera, 6 with Lepidoptera, 6 with Hemiptera, 6 with Odonata, 2 with Thysanoptera, 2 with Psocoptera, 1 with Orthoptera, 1 with Trichoptera and 1 with Collembola.

Professor Balfour-Browne defrayed the entire cost of the plates illustrating his article on the proventriculus in Coleoptera.

Much of the detailed work of the Society's business has been carried out by a Finance and Housing Committee, under the chairmanship of Brigadier W. H.

Evans, a Publication Committee under that of Mr. N. D. Riley, and a Library Committee under that of Dr. K. Jordan, and the thanks of the Council are again due to those Fellows who have served on these Committees.

The Library, both as regards its organisation and the growth of its contents, has continued to make good progress during the year.

Mr. H. Willoughby Ellis generously presented three table lamps of a special design for use on the reading tables, and these have proved very satisfactory in use.

Among the additions to the Library may be mentioned: Hübner, *Erste Zuträge zur Sammlung exotischer Schmetterlinge*, 1808, a photostat copy presented by Mr. H. J. Turner; *Opinions rendered by the International Commission on Zoological Nomenclature*, Nos. 1–29 and 38–51, completing the set in the Library, presented by Mr. John Cowley, and the following purchases: Pontoppidan, *Den Danske-Atlas*, Bd. 1. 1763, *The MSS. diary and catalogue of the collection of C. Kuper*, in 6 volumes, a copy of Heft 191 of Panzer, *Faunae insectorum Germanicae*, of which only one other copy is known, and Müller, *Entomologisches Taschenbuch*, 1800.

Considerable progress has been made with the arranging and cataloguing of the collection of separates, 8,900 having now been dealt with. The use of the Library by Fellows continues to grow, and there is again a satisfactory increase in the number who have borrowed books, viz. :—390 (382), and in the number of books borrowed, viz. :—1270 (1061). In addition several books not in the Library were obtained on loan for Fellows from the National Central Library, and some books were sent on loan to that organisation in return.

The Honorary Secretary of the Committee for the Protection of British Insects reports that the Joint Sub-Committee visited Wicken Fen on June 23rd to inspect the result of the summer cutting which had been carried out the previous summer. The result had been most satisfactory and recommendations were made to the Committee for the management of Wicken Fen that further areas should be cut. The Society's representatives also attended the Annual Meeting which was held at Cambridge in July, and again visited the Fen.

The clearing of overgrown portions of Wood Walton Fen has been continued by the Society for the Promotion of Nature Reserves and advantage was taken of the dry summer to dig out two of the dykes. This should benefit the aquatic Coleoptera, etc., whose habitats were becoming restricted owing to the choked condition of the dykes.

The British Association for the Advancement of Science now has an arrangement with the Ministry of Health under which they receive intimation of Town and Country Planning schemes, in order that, should they learn of any scheme involving sites for the preservation of which scientific arguments could be advanced, they may have the opportunity of approaching the local authority concerned, and also the Ministry.

The Committee has already been able to take advantage of this valuable arrangement in supporting the suggested preservation of the Great Wood at Belfairs, near Southend, which is the habitat of several rare and local insects.

Lycaena dispar batavus suffered badly both at Wood Walton and Wicken Fens from attack by parasites, but fair numbers of the butterflies were observed and it is believed that a good stock of larvae is hibernating in both Fens.

Maculinea arion. The Committee again contributed towards the protection of this butterfly in Cornwall. Not quite so many were observed as last season, but this was thought to be due to the drought. It is satisfactory to learn that our Fellow who is undertaking the protection of this butterfly has been able to arrange that protection should be continued. The Committee wish to tender their thanks to him for his assistance.

The special appeal by the Council for funds to further the work of the Committee resulted in just over £50 being contributed. It is hoped that these subscriptions will be continued. The Committee desires to express their thanks to the donors for their support.

The Committee continues to keep in touch with the National Trust and the Society for the Promotion of Nature Reserves.

The Report was adopted on the motion of Dr. E. A. Cockayne, seconded by Rev. E. B. Ashby.

Mr. Francis Hemming, Treasurer, then read the following :—

Treasurer's Report.

The management of the Society continues to call for close attention, and in existing conditions great care is required if the Society is to maintain the present scale of its activities and at the same time to pay its way from year to year.

On the income account, the two most important items are those in respect of annual contributions and sales of publications. Of these, the former is, over a long period, the best index of the Society's prosperity; while the latter reflects more quickly the trend of business activity.

The number of Fellows is higher to-day than in any year since the beginning of the present economic depression in 1929. The rate of increase during the past year was, however, less than in 1933, which was, it is true, an exceptional year owing to the celebration of the Society's Centenary. It is essential to the well-being of the Society that at least for some time to come there should be a progressive increase in the number of its Fellows. It is to be hoped, therefore, that the gradual return to general prosperity will witness a further growth in the Fellowship.

For the first time for a number of years, the income from the sale of the Society's *Transactions* and *Proceedings* ceased to decline and, indeed, showed an increase of approximately £50. In the years of acute depression through which we have been passing, it was inevitable that income on this account should fall away. The reversal of this tendency disclosed in the accounts for the past year is therefore very satisfactory. There are many signs that the worst of the depression is now over. There are thus grounds for hoping that in the next few years the income of the Society from the sale of its *Transactions* and *Proceedings* may continue to show an upward tendency.

On the expenditure side of the account, it will be seen that by careful administration the " House Expenses " were no higher in 1934 than in 1933. In this group of items is included the normal grant from the General Fund of £80 to the Repairs to Premises Fund. During the year, the whole of the outside of the Society's house was re-decorated. This, however, involved no charge on the General Fund of the Society, as the accumulated resources of the Repairs to Premises Fund were suf-

ficient to defray the cost involved and to leave a small credit balance in the Fund.

Under the heading " Office Expenses " there will be found an increase of £110 as compared with 1933. This is due in part to the normal increment in the salaries of the staff, in part to changes in the Society's seals and stationery consequent on the grant in 1933 of the title " Royal," and in part to the purchase of additional furniture.

The allocation to the Library in 1934 amounted to £146, an increase of £45 on the amount so allocated in 1933.

The net amount expended in 1934 on the production of the Society's *Transactions* and *Proceedings* exceeded that so spent in 1933 by £65. The gross expenditure on this account exceeded that in 1933 by over £100, as a result of an increase in the amount of donations which the Society received towards the cost of publishing particular papers. The Society's thanks for these donations have been recorded in the Council's Report for the year.

The position as regards *Stylops* is definitely encouraging. On the one hand, the volume for the year 1934 was more copiously illustrated and was as large as any of its predecessors. On the other hand, the cost of printing was no higher than in the previous year, thanks in a large measure to the care devoted to its production by its editor, our present President. Finally, there has been a small but definite increase in the sales of this journal, as well as a considerable increase in the contributions received from authors towards the cost of reproducing the illustrations to their papers.

The Income and Expenditure Account shows a small excess of income over expenditure, which is carried to the balance sheet.

The balance sheet itself calls for little comment.

In accordance with the policy announced in the Council's Report last year, the legacy received from the late Professor Raphael Meldola has been allocated to defray the cost of producing the new publication " The Generic Names of British Insects," the first two parts of which were published last spring. This legacy has, therefore, been transferred from General Reserve to a special fund entitled " The Meldola Bequest Fund," to which it has been agreed that receipts from the sale of this publication should also be credited.

It will be recalled that in 1929 the Council obtained an actuarial report on the liabilities at that time of the Compounding Fund. The assets in excess of liabilities which were then disclosed were transferred to the Housing Fund. At the same time it was agreed that the liabilities of the Fund should be re-valued every five years. In the early part of last year there took place the first of these quinquennial valuations. This disclosed a reduction in the liabilities of the fund from £1185 to £876. This reduction was due in part to the death during the quinquennium of seven Fellows who had compounded their annual contributions, and in part to the reduced liability to the Society on account of the annual contributions of the remaining forty Fellows concerned. The period under review has, moreover, witnessed a great rise in the value of gilt-edged securities, which has further increased the excess of the assets over the liabilities of this Fund. On receipt of the valuation report on the 6th March last, the Council decided to leave in the Fund securities to the value of £900 on that day and to transfer the surplus to General Reserve. The sum so transferred amounted to £805.

A small innovation has been made in the accounts this year by the addition, at the end, of a Receipts and Payments Account in respect to the moneys received and expended by the Society's Committee for the Protection of British Insects. Only a small balance remains in the hands of the Committee, who would welcome donations from those interested in the protection of our rarer species.

It will be seen from the foregoing report that in the year just closed the Society has maintained and in some directions extended the scope of its activities. That it has been able to do so without incurring liabilities in excess of its current resources may in the circumstances be regarded as a satisfactory achievement.

The Report and Accounts were adopted on the motion of Mr. H. M. Edelsten, seconded by Sir Edward Poulton.

The President then read his Address, and at its conclusion a vote of thanks to him, coupled with the request that it might be printed in the *Proceedings*, was moved by Dr. K. Jordan, and carried unanimously.

A vote of thanks to the Officers for their services during the year was then passed on the motion of Dr. H. Eltringham seconded by Sir Edward Poulton and carried unanimously. Mr. Francis Hemming and Mr. A. W. McKenny Hughes briefly replied.

THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON.

TREASURER'S STATEMENT OF INCOME AND EXPENDITURE for the Year ended December 31st, 1934.

(Presented at the Annual Meeting, 16th January, 1935.)

GENERAL FUND.

INCOME.

1933. £	£		£ s. d.	£ s. d.
		To subscriptions—		
44		received in advance for 1934 ...	42 0 7	
1,182		received in 1934 for 1934	1,199 18 7	
74		received in 1934 for previous years	56 12 0	
1,300			1,298 11 2	
50		*Less* subscriptions in arrear at 31st December, 1933—valued at ...	75 0 0	
1,250			1,223 11 2	
75		*Add* subscriptions in arrear at 31st December, 1934—valued at ...	85 0 0	
1,325				1,308 11 2
123		,, admission fees		85 2 7
		,, publications—		
364		sales	413 9 3	
57		donations towards cost	93 3 5	
421				508 12 8
2		,, interest on deposit at bank		
55		,, dividends on investments (gross) ...		55 2 8
250		,, rents from sub-tenants		250 0 0
230		,, contributions by sub-tenants towards house expenses		236 2 3
—		,, Hire of Room		8 8 0
4		,, miscellaneous		5 10 0
£2,410				£2,457 9 4

EXPENDITURE.

1933. £	£		£ s. d.	£ s. d.
		By House expenses—		
236		wages	226 3 11	
94		fuel, gas and electric light	91 18 2	
34		insurance and water	34 9 9	
80		repairs fund—transfer	80 0 0	
21		miscellaneous	34 3 9	
465				466 15 7
		,, office—		
638		salaries	673 15 4	
55		printing and stationery	81 18 8	
46		postages	32 17 2	
21		audit fee	21 0 0	
	25	superannuation ... 25 5 6		
		less employees' contributions 11 14 0		
	11			
	14		13 11 6	
3		furniture and repairs	37 10 6	
30		miscellaneous	57 15 7	
807				918 8 9
		,, library—		
101		library fund transfer	146 3 6	
39		furniture	9 13 1	
140				155 16 7
585		,, cost of publications		688 1 7
317		,, "Stylops" cost of printing, &c. ...	322 6 5	
	93	*less* subscriptions ... 103 12 2		
	97 4	donations ... 18 18 0		
220			122 10 2	199 16 3
25		,, donation to Zoological Record ...		25 0 0
17		,, contribution to Centenary fund ...		—
151		,, excess of income over expenditure carried to Balance Sheet		3 10 7
£2,410				£2,457 9 4

STATEMENT OF INCOME AND EXPENDITURE for the Year ended December 31st, 1934.

WESTWOOD BEQUEST FUND.

1933.	Income.	£ s. d.	£ s. d.	1933.	Expenditure.	£ s. d.
£ 7	To Interest on Birmingham Stock	7 3 8	7 3 8	£ 7	By income for the year, carried to Balance Sheet	7 3 8

HAMILTON DRUCE BEQUEST FUND.

1933.		£ s. d.	£ s. d.	1933.		£ s. d.
£ 44	To interest on New Zealand Stock	43 16 6	43 16 6	£ 44	By transfer to Library Fund	43 16 6

LIBRARY FUND.

1933.			£ s. d.	£ s. d.	1933.		£ s. d.	£ s. d.
£	£				£	£		
	44	To transfer from Hamilton Druce Bequest Fund—interest on New Zealand Stock	43 16 6		119	By expenditure on new books	130 6 4	
	101	,, transfer from General Fund	146 3 6		78	,, binding, repairs and insurance	44 4 6	
	8	,, donation by R. W. Lloyd, Esq.	—		197			174 10 10
	—	,, miscellaneous	2 15 0			,, Excess of Income over Expenditure carried to Balance Sheet		18 4 2
	153			192 15 0				
	44	,, excess of expenditure over income, carried to Balance Sheet		—				
	£197			£192 15 0	£197			£192 15 0

REPAIRS TO PREMISES FUND.

1933.		£ s. d.	£ s. d.	1933.		£ s. d.
£				£		
80	To transfer from General Fund	80 0 0		20	By expenditure on repairs	168 7 7
—	,, excess of expenditure over income carried to Balance Sheet	88 7 7		60	,, excess of income over expenditure, carried to Balance Sheet	—
£80		£168 7 7		£80		£168 7 7

MEDOLA BEQUEST FUND.

	£ s. d.	£ s. d.		£ s. d.
To sales	4 9 9		By expenditure on "Generic Names of British Insects" Parts 1 and 2	66 7 9
,, interest on deposit	2 5 0			
		6 14 9		
,, excess of expenditure over income carried to Balance Sheet		59 13 0		
		£66 7 9		£66 7 9

BALANCE SHEET, December 31st, 1934.

GENERAL FUND.

Liabilities.	£ s. d.	£ s. d.	Assets.	£ s. d.	£ s. d.
To sundry creditors	634 8 8		By sundry debtors—		
,, subscriptions in advance	52 8 6		subscriptions valued at	85 0 0	
		686 17 2	admission fees	22 1 0	
,, excess of assets over liabilities :			publication sales	181 15 10	
at 31st December, 1933	32 2 0		rent and contributions to house expenses	183 8 10	
Add excess of income over expenditure for year to date	3 10 7		sundries	5 0 7	
		35 12 7			477 6 3
			,, payments in advance		12 12 9
			,, unsold copies of publications	(Not valued)	—
			,, cash at Bank : deposit account	61 1 4	
			current account	128 11 3	
				189 12 7	
			,, cash in hand	42 18 2	
					232 10 9
	£722 9 9				£722 9 9

WESTWOOD BEQUEST FUND.

	£ s. d.	£ s. d.		£ s. d.
To excess of assets over liabilities at 31st December, 1933	264 7 4		By £239 12*s.* 4*d.* Birmingham Corporation 3% Stock 1947	
Add income from investment for year to date ...	7 3 8		at cost	250 0 0
	271 11 0		(value at date £232 8*s.* 5*d.*)	
Less part cost of plate	14 7 4		,, cash at Bank	7 3 8
		257 3 8		
	£257 3 8			£257 3 8

HAMILTON DRUCE BEQUEST FUND.

	£ s. d.	£ s. d.		£ s. d.
To excess of assets over liabilities at 31st December, 1933	1,000 0 0		By £1,095 15*s.* 6*d.* New Zealand 4% Stock 1943/1963 at cost	1,000 0 0
	£1,000 0 0		(value at date £1,172 9*s.* 5*d.*)	£1,000 0 0

LIBRARY FUND.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
To sundry creditors	23 4 6		By library furniture and fittings	(Not valued)	
			,, library books (valued at £10,000)		
			,, cash at Bank	... ...	12 9 11
			,, excess of liabilities over assets at 31st December, 1933	28 18 9	
			Less excess of income over expenditure for year to date	18 4 2	
					10 14 7
	£23 4 6				£23 4 6

BALANCE SHEET, December 31st, 1934.

REPAIRS TO PREMISES FUND.

Liabilities.	£ s. d.	£ s. d.	Assets.	£ s. d.
To sundry creditors	... ...	20 12 6	By cash at Bank	47 1 9
To excess of assets over liabilities at 31st December, 1933	114 16 10			
Less excess of expenditure over income for year to date	88 7 7			
		26 9 3		
		£47 1 9		£47 1 9

HOUSING FUND.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
To excess of assets over liabilities at 31st December, 1933 ...	£13,417 3 4		By freehold premises, 41, Queen's Gate, at cost	6,250 0 0	
			,, cost of New Meeting Room Scheme	7,167 3 4	
					13,417 3 4
		£13,417 3 4			£13,417 3 4

COMPOUNDING FUND.

	£ s. d.	£ s. d.		£ s. d.
To excess of assets over liabilities at 31st December, 1933	1,185 0 0		By £1,094 4*s.* 5½*d.* 2½% Consols valued at 6th March, 1934 (value at 31st December, 1934, £1,017 12*s.* 6*d.*)	900 0 0
Add appreciation in value of investments at 6th March 1934	520 2 5			
	1,705 2 5			
Less transfer to general reserve	805 2 5			
		900 0 0		
(representing estimated liability of Fund at that date—subject to revision quinquennially.)				
		£900 0 0		£900 0 0

GENERAL RESERVE.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
To excess of assets over liabilities as at 31st December, 1933	450 0 0		By £259 17*s.* 9*d.* 2½% Consols valued at 6th March, 1934 ...	213 14 11	
Less transfer to Meldola Bequest Fund—bequest by the late Professor R. Meldola	450 0 0		,, £532 3*s.* 5*d.* 4% Consols valued at 6th March, 1934 ... (value at 31st December, 1934, £868 5*s.* 10*d.*)	591 7 6	805 2 5
Add transfer from Compounding Fund	805 2 5				
		805 2 5			
		£805 2 5			£805 2 5

MELDOLA BEQUEST FUND.

	£ s. d.	£ s. d.		£ s. d.
To excess of assets over liabilities			By sundry debtors	1 8 4
Transfer from General Reserve—Bequest by the late Professor R. Meldola	450 0 0		,, cash on deposit at Bank	388 18 8
Less excess of expenditure over income for year to date	59 13 0			
		390 7 0		
		£390 7 0		£390 7 0

(Signed) Francis Hemming, *Treasurer.*

We have examined the above Balance Sheet and Accounts with the Books and Vouchers of the Society and certify them to be correct. The Solicitors have certified to us that they hold the deeds of 41, Queen's Gate for safe custody on behalf of the Society, and we have verified the Investments and Bank Balances.

23, *Queen Victoria Street,*
London, E.C. 4.
9th January, 1935.

(Signed) W. B. Keen & Co., *Chartered Accountants.*

COMMITTEE FOR THE PROTECTION OF BRITISH INSECTS.

RECEIPTS AND PAYMENTS ACCOUNT for the year ended 31st December, 1934.

RECEIPTS.	£	s.	d.
To balance 1st January, 1934, in hand			10
,, donations	52	16	6
	£52	17	4

PAYMENTS.	£	s.	d.	£	s.	d.
To expenditure on preservation of *M. arion* and *L. dispar* ...	34	15	0			
,, cheque book...		5	0			
				35	0	0
,, balance 31st December, 1934: at Bank	15	15	4			
in hand...	2	2	0			
				17	17	4
				£52	17	4

(Signed) FRANCIS HEMMING, *Treasurer.*

We have audited the above Account of Receipts and Payments and certify same to be correct. We have verified the balance at the Bank.

(Signed) W. B. KEEN & Co., *Chartered Accountants.*

23 *Queen Victoria Street,*
*London, E.C.*4.
9th January, 1935.

THE PRESIDENT'S ADDRESS.

Ladies and Gentlemen,

Though the year under review has been uneventful compared with the preceding one, in the course of which we celebrated our Centenary, the reports of the Council and of the Treasurer, which you have just heard read, are evidence of the highly satisfactory progress of our Society, thanks to the unremitting trouble taken by our Honorary Officers and our Registrar. No one is in a better position than myself to appreciate what this amounts to, though I often think that those Fellows of our Society who have not had opportunities of being closely conversant with the conduct of its affairs seldom realise what a large number of hours in the year has to be given to our service by an Honorary Officer if he is to do his duties conscientiously.

Though fifteen years is a very short time in the life of a learned Society, those of you who recall the days when we were at Chandos Street will realise the profound changes that have since taken place, more especially in the scope and magnitude of our various undertakings. The increased importance of our status among learned Societies, however, carries with it further responsibilities. That this has been recognised by our Council is, I think, evidenced by their decision to produce what I venture to predict will be a work of outstanding importance, *viz.* :—*The Generic Names of British Insects*. Of this, as you know, two parts have already appeared, and others are in preparation. If I make special mention of any of those who have been instrumental in bringing it into being, they must be our Treasurer, Mr. Francis Hemming, who is himself the author of the first list to be published, and Professor W. A. F. Balfour-Browne, who is the Secretary of the Committee in charge of the work.

Another enterprise to which I should like to see some consideration given, when funds permit, is the preparation of an up-to-date catalogue of our now magnificent library. It is already thirty-four years since the last supplement to the existing catalogue was issued, and in the interval that has elapsed we have made enormous additions of many rare books to our collection. A complete catalogue of the library would, I feel sure, be a bibliographical tool of the utmost value to all entomologists.

It now becomes my duty to place on record the losses that the Society has sustained by death during the year. These are somewhat fewer than in recent years, being ten in number.

By the death of the Rev. William Frederick Johnson in his 82nd year, the Society has lost one of its older Fellows. He was elected in 1889 and was created a Special Life Fellow in 1923. He became interested in Entomology early in life and is said to have collected Lepidoptera as long ago as 1863. Later on he also

became greatly interested in other orders, especially the Coleoptera and Hymenoptera, and he contributed many papers on these and other insects chiefly to the *Irish Naturalist* and to the *Entomologist's Monthly Magazine*, to the editors of which I am indebted for many of these particulars.

Cyril Benoni Holman-Hunt, who was born at Florence in 1866, was the son of the famous painter, W. Holman-Hunt, O.M. He was educated at Harrow and St. John's College, Cambridge. He became a medical student, but did not find this congenial and gave it up in order to go abroad where he might gratify his love of natural history, particularly of Entomology. He spent a number of years as a tea-planter at first in Ceylon and later in South India, but it was not until 1909, when he was appointed Entomologist at the Kuala Lumpur Museum, that he was entirely in his element. During this period he published several papers on insect pests of agriculture. He retired in 1921 and spent his remaining years in Dorset. He had been a Fellow of our Society since 1898 and, though not often present at our meetings, paid occasional visits to the library after his return to England. He died at Bridport in July last, and his will contains a clause bequeathing to us the sum of £100 for " the purchase of or on the production of illustrations for books of interest to the Society." I am greatly indebted to his sister, Mrs. Joseph, for these particulars concerning him.

Alfred Hyde Martineau, who had been a Fellow since 1897, was in his earlier years an active member of the Birmingham Natural History and Philosophical Society, of which he was President in 1905. He was especially interested in the Aculeate Hymenoptera, his collection of which, according to the *Entomologist's Monthly Magazine* to which I am indebted for these details, is being presented by his widow to the Birmingham Natural History Society.

George B. Routledge, who had been a Fellow since 1890, was born in 1864 and at one time attended our meetings fairly frequently, though he had not done so for many years. He was a great authority on the insects of Cumberland, and he published many papers on them in the *Transactions of the Carlisle Natural History Society*. It is anticipated that his large collections will be deposited in the Carlisle Museum.

Matthew Lawson Thompson was born in 1866 and became a Fellow in 1901. He was a prominent member of the Yorkshire Naturalists' Union and was an ardent naturalist. He was seldom able to attend our meetings, but many will remember him as having been present at our Centenary celebrations at which he represented the Yorkshire Naturalists' Union. His special interest was in the Coleoptera, and he took a leading part in the preparation of the list of the beetles published in the Victoria County History of Yorkshire.

Other Fellows whose loss we have to deplore are W. Mansfield Aders, for many years Government Entomologist in Zanzibar, who was elected a Fellow in 1919, J. B. Hicks elected in 1923, Major H. C. Jeddere-Fisher elected in 1928, R. Kelly elected in 1926, S. T. Klein elected in 1887, and G. C. Leman elected in 1920.

Of those who have died during the year who were not Fellows of the Society, special mention must be made of one who, though not himself an entomologist, rendered great services to our Society. For the following particulars concerning him I am greatly indebted to my old friend and former teacher Sir Edward Poulton, our Honorary Life President :—

James Mark Baldwin, the world-famous psychologist, who died on 8th November, was deeply interested in evolution and natural selection. He presented to Oxford University, in the name of the then Hope Professor of Zoology, the "Fund for promoting the study of Social and Organic Evolution" which has provided grants in aid of many important researches. It will be remembered that this Fund, administered by the University Chest under the authorisation of the Hope Professor, has often granted valuable assistance to our publications in recognition of the intimate relation between the study of insects and the problems of evolution. Professor Baldwin and his friends, Professor Lloyd Morgan and Professor Fairfield Osborn, independently originated the important theory for which Professor Baldwin proposed the name "Organic Selection"—the power of individual adaptability enabling a species to survive through a period of changing environment or other stress until relieved by the appearance of some fresh inherent variation.*

An excellent account of Professor Baldwin's great work in Psychology was published in *Nature* of 1st December, 1934.

Our science has also suffered a grievous loss in the untimely death of that great American Dipterist, John Merton Aldrich, at the age of sixty-eight. The loss is all the greater in view of the fact that in recent years he had largely been devoting his attention to the parasitic flies of the family Tachinidae, which are of such great economic importance and respecting which our knowledge is still very imperfect.

I will ask you to rise for a moment as a token of respect to the memories of our colleagues who have passed away.

It has probably been said on many occasions similar to the present that no one ever reads a Presidential Address except the author of it. Perhaps it is for this reason that custom ordains that you have to undergo the ordeal of having it read to you at our annual meeting. For many years after our Society was founded, it was customary for the Presidential Address to consist of a summary of the principal entomological events and publications of the year. With the growth of the whole subject and especially of the literature, this became a more and more onerous task, and the custom inevitably languished. Naturally enough the Address then began in most cases to take the form of an account of some subject with which the occupant of the Presidential Chair had some special acquaintance.

It has been my experience to listen to, and on two occasions to read on behalf of absent Presidents, a large number of Presidential Addresses, and I have come

* This subject was discussed at the Detroit meeting of the American Association for the Advancement of Science in 1897 (1897, *Proc. Amer. Ass. Adv. Sci.*, **46** : 239–242). See also 1901, *Hope Reports*, **2** : No. 14A.

to the conclusion that such addresses should have two main features. They should be short and they should deal with a general subject that is likely to interest in some degree most of those present. Fortunately for myself, the first of these principles closely coincides with my personal inclinations, and such special knowledge as I possess assists me towards carrying out the second.

I therefore propose to-night to ask you to listen to a short account of

The Development of Bibliographical Work relating to Entomology.

I have chosen this subject, partly because I have myself been largely associated with work of this character in recent years and partly because I wish to emphasise its fundamental importance, if the science of Entomology, or for that matter any other branch of Natural Science, is to progress. The army of research workers is ever growing and, though the field itself is always widening, individually they tend to study a narrower and narrower one more and more intensively. Without the assistance of elaborate bibliographies and similar publications, they therefore stand a grave risk of being entirely overwhelmed in the flood of literature that now represents the world's output of their results. Even so long ago as the end of the eighteenth and beginning of the nineteenth centuries, relatively scanty though the literature of our subject then was, it was beginning to be recognised that something was required to help the individual student and research worker to find his way about. I do not, however, propose to weary you with a complete history of the bibliographical work that appeared during the last century, more especially as a good account of the principal works of this character was published by one of our Fellows on the other side of the Atlantic a few years ago.* I will therefore mention only a few of the more interesting and important.

Naturally enough many of these works deal with Zoology as a whole, and Entomology only occupies a relatively small part of them. One of the earliest of this type is Dryander's † Catalogue of the library of Sir Joseph Banks which was published from 1796 to 1800 in five volumes of which Volume 2 is devoted to Zoology and in which the works on insects occupy eighty pages.

The earliest work that I have been able to trace which deals solely with Entomological literature is a very rare little book by Charles Nodier. A copy of this, which formerly belonged to Victor Audouin, is I am glad to say in our own library, though it is unfortunately somewhat imperfect. It is entitled "Bibliographie entomologique ou Catalogue raisonné des Ouvrages relatifs à l'Entomologie et aux Insectes," and is a small 12mo. pamphlet of viii + 64 pages (not 24 as stated by Sherman) of which pp. 13–24 are wanting in our copy, and it was published in Paris in "an IX" of the First Republic, *i.e.* 1801. It is divided into two main sections devoted to descriptive and philosophical Entomology respectively, and it is of interest to observe that the proportion of works devoted at that time to the morphology or classification of insects, compared with that dealing with their relations to mankind, was much smaller than is the case at the present day.

The next work of the kind that deals solely with Entomology, to which I shall

* Sherman, J. D. 1924. Some entomological and other bibliographies. *J. N. Y. Ent. Soc.*, **32** : 206–215.

† I have to thank our Registrar, Mr. F. J. Griffin, for giving me the opportunity of examining this rare book from his own library.

mainly confine my remarks, was Eiselt's "Geschichte, Systematik und Literatur der Insectenkunde," published at Leipzig in 1836. It occupies 255 pages and professes to include all the literature from Aristotle to that date. The first 120 pages, however, deal mainly with systems of classification. The remaining bibliographical portion is divided under subjects, and it is interesting to note that the section devoted to works on what we should now call Economic Entomology contains 57 titles.

This was followed almost at once by Percheron's "Bibliographie entomologique" in two volumes, published in Paris and London in 1837. This also endeavoured to cover the literature from the earliest times up to 1834. It is arranged under authors, but also comprises a list of anonymous works, a list of the journals containing entomological papers and a table arranged under subjects to the authors contained in the first part.

The next publication of importance is Hagen's famous "Bibliotheca Entomologica," published at Leipzig in 1862. There is no need to describe this invaluable work, which is well known to you all, but the opportunity may be taken of wishing success to one of our Honorary Fellows, Dr. Walther Horn of Berlin, who is undertaking the arduous task of preparing an up-to-date supplement to it.

The year 1864 saw the appearance of the first volume of the world famous *Zoological Record*, respecting which a few details may be of interest. It was at first known as the *Record of Zoological Literature*. The first editor was Dr. Albert Günther, and it was published as a private venture by Van Voorst. As might have been expected in the light of modern experience, this enterprise was not a financial success, and it only survived until 1871, when six volumes had been published. Fortunately the situation was saved by the prompt formation of the Zoological Record Association, in the foundation of which one of our most distinguished past Presidents, H. T. Stainton, was largely instrumental, and to the maintenance of which many other Fellows of our Society were subscribers. With the assistance of this body, the *Record* was carried on for a further sixteen years. By 1887, however, owing to financial difficulties, it found itself unable to continue the publication, and in that year, beginning with Volume 23 (literature for 1886), the responsibility was taken over by the Zoological Society of London, in whose hands it has remained ever since. A full account of the invaluable service that that Society has done in this connection will be found in its Centenary History.*

The "Insecta" portion of this work occupies approximately half the whole, and its importance to entomologists is incalculable. During its earlier years, its form differed somewhat from that adopted at the present day, such changes as have been made being designed to keep the work within reasonable limits in view of the ever increasing bulk of the literature. The titles, comprising the bibliographical portion, were in the early days often accompanied by brief abstracts or descriptive notices, and more space was found for particulars of known species than is possible at the present day. Moreover, since the Imperial Institute of Entomology undertook the preparation of the "Insecta" part in 1924, it has been found justifiable to omit the papers relating primarily to Economic Entomology, since these are all fully dealt with in the *Review of Applied Entomology*.

* 1929. P. Chalmers Mitchell. *Centenary History of the Zoological Society of London*, pp. 120–124.

Another work somewhat comparable with the *Zoological Record* is the special volume of the *Archiv für Naturgeschichte* known as the *Bericht über die Leistungen im Gebiete der Naturgeschichte*. This began in the year 1835, but has not been carried beyond the literature for 1915, and there seems to be little prospect of its resuscitation. The work is an inconvenient one to use owing to the absence of any alphabetical list of authors.

It will thus be seen that, by the end of the nineteenth century, considerable endeavours had been made to meet the wants of those interested in Systematic Entomology and in the purely scientific aspects of the subject.

It was not, however, until some years later that the ever-growing flood of literature steadily spreading over a wider and wider field in the biological sciences brought about the need for something more than bibliographies that were primarily lists of titles only. At first attempts were made to meet this demand by the publication by various journals of a limited number of selected abstracts that were in the nature of supplements to their main subject matter.

So far as Entomology was concerned, nothing was yet in existence that met the necessity for bringing together in a compact form the rapidly growing literature on the applied side of the science, relatively small though it then was as compared with the present day, and it was not until 1913 that an attempt was made to meet this need, when the Imperial Bureau (now Institute) of Entomology undertook the publication of the *Review of Applied Entomology*.

This journal, as many of you know, aims at publishing summaries of the whole of the world's literature in two series, one dealing with Agricultural, and the other with Medical and Veterinary, Entomology.

As I have been closely associated with its publication for more than twenty years, I may perhaps be allowed to describe in some detail the methods of producing an abstracting journal of this character and to discuss the fundamental principles involved. It will probably be generally agreed that these should at least include the following :—

(1) An abstracting journal should be as up to date as it is possible to make it ; (2) it should endeavour to cover the whole field of the literature, including all languages ; and (3) it should have a very complete subject index to each volume. Further, in my view, the subject it deals with should be confined within certain definable limits. In these days of an ever-growing tendency to increased specialisation, any attempt to produce an abstracting journal that deals with, say, the whole of biology seems to me to defeat its own object. It is often the case that the scope of a single paper is such that several useful abstracts might be made from it, which might severally be written for the benefit of an Entomologist, Mycologist, Veterinary Officer, etc., but a reasonably short, single abstract of which, directed to biologists in general, would be useless to any one of them.

The work of producing an abstracting journal may roughly be divided into four main branches :—

(1) The collection of the raw material.
(2) The making of the abstracts.
(3) The editing of the abstracts.
(4) The preparation of the index.

The Collection of the Raw Material.

Experience has shown that it is practically impossible for the staff of an abstracting journal adequately to search the whole of the world's literature on a given subject unless the institution to which they belong either possesses an extensive library of its own or at least has unimpeded access to one. Only by this means can a check be kept on the vast number of journals and reports that must be examined, or the originals that are frequently required for subsequent reference long after the abstract itself has been made and published, be consulted. In the case of the *Review of Applied Entomology*, the number of journals or series of reports that require examination is between eleven and twelve hundred, to say nothing of numerous separates from journals that do not normally publish entomological papers.

The Making of the Abstracts.

The abstracts themselves may be made on several different systems. In the United States an attempt has been made to carry on an ambitious journal, *Biological Abstracts*, largely by inducing authors themselves to provide abstracts of their own papers. This is, in my view, a fundamental error. Apart from the grave disadvantage that it makes prompt publication of the finished abstract impossible, the author himself is by no means necessarily the best medium for producing it. He tends to look at the subject matter from far too limited a point of view, and commonly fails to emphasise the very points that readers need. Furthermore, human nature being what it is, the percentage of authors that can be relied on to provide a regular supply of abstracts must be a very small one.

Another method, but one that is only applicable to certain subjects, is to divide up the work among a number of expert sub-editors, each of whom has to deal with all the literature in a special field. This has been practised with success especially in the medical and veterinary sciences. It necessarily, however, involves considerable delays in the production of the finished article, since it is impossible to maintain a permanent staff of such experts under one roof, and these, if only on account of the language problem, must necessarily be scattered over a wide area.

This method would, however, be quite unworkable for such a subject as Applied Entomology, in view of the huge and ever-increasing field that it covers. The knowledge required by those concerned in its production needs to be on two entirely distinct planes, the technical plane and the language plane, and it would be out of the question to find, say, a sub-editor who, knowing Russian and Serbian, also had some acquaintance with the whole of the order Insecta as well as of all the ramifications into other sciences, such as Chemistry and Physics, into which Applied Entomology carries us at the present day.

Consequently a third method is the one employed in the production of the *Review of Applied Entomology*. In this case the abstractors themselves are not trained entomologists at all, but are selected primarily for their general education and their knowledge of languages. Though in course of time they necessarily acquire a wide general knowledge of the subject, they have not themselves had any technical training in it. Experience has shown that by this means, especially in the case of abstracts made from foreign originals, a more accurate account

of the author's work can be produced, and this can then be checked over for its technical accuracy and put into shape by the editorial staff. Furthermore, it is not desirable that the abstracts should be critical, and this is much less likely to occur where the abstractor's interest in, or knowledge of, the subject is not that of the specialist, whose attitude to the subject matter of a paper is almost unavoidably affected by its agreement or otherwise with his personal views. The function of the abstract should be to give the reader in as compact a form as possible what the author has said, and it should only call attention to errors where they are clearly mis-statements of fact.

One great advantage of this method is that it enables practically the whole staff, both abstracting and editorial, to be employed together under the same roof as that under which their raw material is received and catalogued and the sources of reference required for their work are filed. This is the only method that I am aware of by which an abstracting journal can be maintained really up to date, and it is by this means that the standard adopted by the *Review of Applied Entomology* is maintained, *viz.* :—a part appearing at the end of a given month contains abstracts or titles of practically all the literature that has been received to within seven or eight weeks previously.

The Editing of the Abstracts.

One of the first functions of the editor is the selection of his material, and this tends to become more and more difficult with the expansion of the literature not only in bulk but also in variety of subject. Some twenty years ago this problem was a less troublesome one because it was possible to include practically the whole of the literature. Not only was the matter less varied, but a very high percentage of it was more or less original. At the present day new subjects continually make their appearance. For example, the relation of insects to virus diseases of plants, or of that of the physico-chemical conditions of water to the distribution of mosquitos are two among many that have developed a considerable literature of their own in recent years. Many others have a somewhat indirect connection with Entomology and yet can hardly be reasonably ignored, *e.g.* the removal from apples of arsenical residues that are the result of spraying against insects. The editor must also try to foresee what subjects are likely to expand into important ones even though they may seem of slight significance when first mentioned in the literature. Moreover, now that the *Review* has just completed its twenty-second volume, it is quite natural that it should be made use of by those who write up articles on a given subject. Unless, therefore, care is taken, the editor tends to find himself involved in a sort of vicious circle in which he publishes an abstract of a summary of his own abstracts! Experience shows, too, that there are two distinct ways in which originals may have to be treated. In the case of a monograph or any very large work, it is obviously impossible, for reasons of space, to give details or any actual abstract of the contents, and the most that can be done is to give a descriptive account of them. The shorter paper, on the other hand, can usually have its essence given in some detail. Between these two extremes, however, are innumerable intermediates as to the treatment of which the editor must decide, having regard at the same time for extraneous factors,

such as the accessibility of the journal concerned and the language in which the paper is written.

Another important editorial duty is to endeavour to help the reader by adding to the information given by the original author by means of an elaborate series of cross references to abstracts of other works on the same subject, some of which the author may not himself have been acquainted with.

The problem, too, of the almost infinite number of scientific names involved is a serious one that is much more pronounced in Entomology than in any other branch of biology. A recent estimate of the generic and subgeneric names alone that have been proposed in Zoology indicates that their number approaches 200,000, of which about 60% are insects. It is obvious too that in a work of reference, if only for indexing purposes, it is essential that such names must all be synonymised to conform to the accepted nomenclature. The necessity for doing this does not seem always to be realised, and it may be worth while to give a simple example to illustrate the problems that may arise. In 1934 Dr. N. H. Swellengrebel pointed out the importance of distinguishing between closely allied Anophelines such as *Anopheles sundaicus*, which transmits malaria, and *A. ludlowi*, which is believed not to do so. The 1933 volume of the *Review* contains references to the former in seven papers, but only in the last two of these was the species recorded under this name (*sundaicus*) in the original. Consequently the information in the other five would all have been attributed to *A. ludlowi*, if the species had not been checked in the course of editing and indexing.

Troublesome problems of nomenclature also arise in respect of the popular names of insects. These may differ in various parts of the English-speaking world for the same insect, or in some cases the same name may be used for different species in the Old and New Worlds. Somewhat similar difficulties arise regarding the exact identity of diseases with which insects may be associated or of food-plants, when given in a foreign language, and much time is often taken up in ascertaining these, with very little that is apparent to show for it.

All this involves a very great deal of labour, and many hundred names a month have to be checked from the office records, the principal catalogues, etc. Though the best authorities for each order or family are followed, there are many respecting which there is no recognised one, or authorities differ in systems of classifications that are as yet incomplete, and in these cases it is wise to follow a very conservative policy and to avoid changes until they have received some degree of acceptance.

From an administrative point of view the editor also has a difficult task in that he can only predict very roughly the amount of the world's literature. He is therefore very much in the position of the manager of a factory who has no control over either the quantity or quality of raw material he has to deal with. However much there may be of it and however refractory it is, he has to devise means of converting it into the finished article. In practice the monthly output of the combined series of the *Review* amounts to about 250 abstracts and titles, and these have to be published regularly on a specified date. Consequently a very carefully constructed timetable has to be prepared in consultation with the printers and rigidly adhered to by both parties.

The Preparation of the Index.

" Index learning turns no student pale,
Yet holds the eel of science by the tail." *

It is indisputable that a full subject index is an essential feature of any abstracting periodical and that without it such a publication fails in fulfilling its object. It must be most carefully planned, and its main headings well thought out. In this connection those responsible for its production must not only have a very thorough knowledge of the subject, but must be endowed with some power of foresight, since it not infrequently happens that a point of apparently minor importance, that does not seem to justify being given a separate entry, develops in a few years into one of the major ones. Moreover, owing to the concentrated character of the matter in an abstracting journal, the index itself must be proportionately very much bulkier than is the case with that of a volume containing original papers only.

The problems of synonymy, to which attention has already been drawn, reach their maximum in the index, and in the course of preparing this, advantage is taken to revise the names, some of which have to be altered during the issue of a volume in the light of recent research.

The final assembly of the very large number of entries in an annual volume is an onerous task, and it involves a considerable exercise of the critical faculties. Though it is desirable to retain as much uniformity as possible between one year and another, this can never be entirely obtained in practice owing to the continuously changing character of the data.

Exacting work of this kind is sometimes lightened by unintentional wit on the part of the typist; on one occasion, when an entry should have recorded a pest as having been " intercepted on ornamental plants in Hawaii," the letter " l " in " plants " was omitted !

This, then, is a brief account of one method of producing a somewhat large abstracting journal under modern conditions, and I venture to hope that you have not found the recital of it unduly wearisome.

* Pope. *Dunciad*, **1** : 279.

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PROCEEDINGS OF THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

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ERRATA.

P. 8, lines 9 and 12 from bottom, for "*bohemanni*" read "*bohemani*."
P. 55, line 26, for "*brocei*" read "*brucei*."

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